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ABSTRACT

This report describes a study conducted to provide information that could be used as a basis for program decision making when adult basic education (ABE) program personnel in Washington purchase an integrated computerized learning system. During the project, the following activities were carried out: (1) programs and systems in use in ABE programs in the state of Washington during the 1989-90 school year were identified; (2) an advisory committee was formed; (3) evaluation criteria for use in looking at large computer-based instructional systems were developed; (4) five systems currently in use in Washington that have high consumer interest were identified; (5) an in-depth, on-site examination of these five systems was conducted; and (6) a final report was prepared with specific information about each system. Systems evaluated and described in this report are the CCC Instructional System (Computer Curriculum Corporation, Palo Alto, California); CCP System (Comprehensive Competencies Program, U.S. BASICS, Alexandria, Virginia); ClassWorks System (Computer Networking Specialists, Walla Walla, Washington); PLATO System (Control Data, Rolling Meadows, Illinois); and WICAT System (WICAT Systems, Orem, Utah). A matrix compares characteristics of the five systems. Survey results and the evaluation instrument and checklist are appended. (KC)

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An Examination and Evaluation of Large Computer Systems for Use in Adult Basic Education Programs

May, 1990

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An Examination and Evaluation of Large Computer Systems for Use in Adult Basic Education Programs

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AN EXAMINATION AND EVALUATION OF FIVE INTEGRATED LEARNING SYSTEMS

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Section 1: FINAL REPORT SUMMARY

Introduction

During the last several years, there has been a proliferation of large and expensive computer-based instructional systems aimed at the population of adults who require remediation in basic skills. These systems often range in price from $50,000 to $125,000. The companies which produce these programs base their advertising on claims that these systems are efficient and effective, allow dramatic grade level gains with limited instructional hours, and minimize the need for professional staff. Some of these systems are, in fact, student management systems, while others are a collection of drill and practice exercises. Staffs of ABE programs are faced with decisions on what equipment and software are appropriate for purchase. They must know what available options would best meet their program's needs and would be the best expenditure of limited dollars available.

Recognizing that much of the information which comes to a program is gained from the salesperson representing any given system, this Special Project was designed to provide basic information which could be used as a basis for program decision-making when ABE programs decide to purchase an integrated learning system. The project set the following goals:

1. To identify programs and systems in use in ABE programs in the state of Washington during the 1989-1990 school year.
2. To form an advisory committee of interested individuals who have practical experience with these various systems.
3. To establish a set of evaluation criteria suitable for use in looking at large computer-based instruc tional systems. To review and finalize these criteria with the advisory committee.
4. To identify five systems currently in use in Washington which have high consumer interest.
5. To conduct an in-depth, on-site examination of each of these five systems.
6. To prepare a final report with the examination instrument and specific information on each system evaluated.

The Advisory Committee

The following persons agreed to serve as an informal Advisory Committee:

Susan Fish, Director of Adult Basic Education at Big Bend Community College
Bill Guise, Director of Federal Programs for the Highline School District
May Haley, CCP Lab Coordinator at Skagit Valley College
Richard Johnson, Learning Center Director at Washington Institute of Applied Technology
Kathy Kieffer, Learning Lab Coordinator at Clover Park VTI
Daren vom Steeg, ABE Director at Clallam Bay Correctional Facility

The Preliminary Survey

All Adult Basic Education programs in Washington, Oregon, and British Columbia were surveyed during October, 1989, in order to identify which systems were currently in use in those states. This list can serve as a resource to other programs which may wish to do on-site visits prior to purchasing new equipment. The survey results are contained in Appendix 1, p. 35.

The Evaluation Criteria Instrument

With the help of the Advisory Committee, an extensive evaluation document was developed, reviewed, and modified by all advisory committee members. This tool was subsequently used in the on-site visits to specific programs. It is an appropriate instrument for other programs to use for self-diagnosis when determining what systems may be appropriate for their purchase. The Evaluation instrument is included as Appendix 2, p. 37. Also developed was a checklist form of the instrument, which lists items to be considered in making any program determination. This short form is included as Appendix 3, p. 44.

Selection of the Systems for In-depth Examination

The project staff consulted with the Advisory Committee to determine which five systems were most appropriate for the in-depth study comprising the major part of the project. The systems selected were:

CCC, Computer Curriculum Corporation
CCP, Comprehensive Competencies Program
ClassWorks, Computer Networking Specialists
PLATO, The Roach Organization
WICAT, WICAT Systems

Individual sites were also identified. At the recommendation of the committee, however, it was decided to let the publisher's representative pick the site for the in-depth visit, thereby insuring that a model site was visited.

Site Visits
Each site was visited for at least one full day. Staff and students were interviewed, and the examination instrument was completed. The specific reports on each program observed make up Section Four, starting on page 11 of this Final Report.

General Issues for Consideration
After all site visits were concluded, a series of General Issues for Consideration were identified. These issues, discussed in Section Two, pp. 4-6, should be considered by any program which is in the process of selecting any Integrated Learning System for purchase or lease.

Specific Issues for Consideration
Besides the general issues which should be resolved in deciding to move to a large, computer-based instructional system, there are a series of specific issues which should be analyzed in relation to each product under consideration. These issues are discussed in Section Three, pp.7-10. It is recommended that any program reach clear decisions on the importance of each of these factors when selecting any program.

System Reports
Section Four, starting on p.11 of this report, includes the detailed description and analysis of each of the five systems studied. Strengths and weaknesses, in the opinion of the researcher, are discussed.

Summary Matrix
In addition to the in-depth discussion of each system, a Summary Matrix (Section 5) was developed which allows staff to see the key points for consideration in each of the five systems. Project staff urge, however, that any program considering purchase of an Integrated Learning System read the detailed discussion carefully before selecting a system.

Final Report Conclusions
This Final Report for the Project provides information on the process under which the project was conducted, as well as the detailed content of the results of the study.

The project was completed in May, 1990. It must be pointed out that all these systems are constantly being modified and improved by their publishers, and what is reported here was what was observed during the 1989-90 school year. Anyone considering purchase in the future should carefully check for changes and improvements in each of the systems which may make them more appropriate for any given setting.

Section 2: GENERAL ISSUES

There are some considerations in the use of an Integrated Learning System (ILS) which are controlled more by the individual program than by the ILS which is used. Because they are controllable by the program, it is essential that these factors be examined as a part of the planning process.

Staffing/Training

None of the systems examined is so complicated that it requires staffing with experienced computer personnel. The training and documentation provided are adequate to insure a system's effective use. Of course, staff chosen for primary lab responsibility ideally should feel comfortable with computers and enthusiastic about the contribution they can make to the program.

Every system needs to have at least one person with primary responsibility for its use, a person with strong organizational skills and the ability to work well with students, not necessarily a strong computer background. It is not workable to have a number of instructors equally sharing this task; one person should monitor the overall use and maintenance of the system and report and correct any difficulties. Beyond that requirement, there are several different staffing designs which can be effective.

Technical staff: One program design uses a technical-type person to act as a lab manager. A person in this role primarily monitors the correct use of the system, answers user questions, and provides instructional staff with student performance records. Instructors still need to be available to provide the bulk of supervision of student learning activities.

Clerical staff: Integrated Learning Systems automatically do most student record-keeping, so that a clerical staff member may not be needed. Most of the systems have no provision for handling any needed institutional reports, however, so time must be alloted for that as well as student registration, answering the telephone, etc. Programs which choose to purchase CCP and to become a member of the U.S. Basics collaboration especially need to consider the use of a clerical aide, since members of that collaboration do extensive information gathering and reporting.

Instructional staff: The instructor is the most important factor determining the success or failure of any system. Even the most sophisticated integrated learning system does not have the capacity to show students how to work effectively with others, and systems are usually somewhat limited in their ability to teach problem-solving or to show the application of skills in life situations. This makes it essential for an ILS to be complemented by classroom instruction or individual tutoring. Most of the systems recommend that an ILS be used as one part of an overall program in which learning is structured by a qualified instructor.

Training: Some amount of training is provided with the purchase of every system. In most cases, this training is provided on-site to as many staff members as will be involved with the use of the system. The length of the training varies, but all publisher representatives indicated that if the initial training were inadequate, further training could be provided until the staff felt comfortable. The best training model is to have up-front training before the system is implemented with students, then additional follow-up training after a few weeks of system use, to work out any "bugs." It would be ideal for staff members to have one or two days or even a week following the training to work with the system without any students.

An important consideration for programs with a high staff turnover rate is the availability and cost of training for new staff members, as well as whether on-the-job training is sufficient or the company requires staff members to complete the company's training program.

Facilities

The room selected to house the ILS will need to be large enough for the number of work stations purchased as well as any additional instructional materials. (In the case of CCP, for example, materials include video tape players and extensive print libraries.) The room will need to have adequate electrical service for all of

the work stations and be fairly secure and well ventilated. Chalk boards are not good co-habitants with computer systems. One lab manager suggested that a good addition to a system would be keyboard "skins," which make keyboards much less susceptible to dust, cookie crumbs, or coffee spills.

The management station could be housed in the same room or in an adjacent room. Having it in the same room makes it easier for the lab manager/instructor to interact with students, while housing it separately makes it more difficult for students to enter the management system and alter records. Though most systems have a "password" to provide some security against system break-ins, if security is a concern it would probably be worth considering putting the management station in a secure location.

Systems which require a modem for communication with the corporation or for management of remote sites will need to have a telephone line.

Scheduling
There is no attendance pattern or schedule inherent in these systems. It is possible for students to attend at any time, for any length of time. The attendance pattern of students and the amount of time spent on the computer and on other activities, combined with the ability to provide staffing, would determine the number of students who could be served. The systems themselves are completely flexible and could operate 24 hours a day.

The student workstations are usable with other, non-system software so that classes such as word processing or computer programming could also be scheduled. (Software which can be used is dependent upon the hardware and software configurations of a system — see individual reports.)

Section 3: SPECIFIC ISSUES EXAMINED

These are areas which need to be considered when looking at any large system. The individual system reports which follow include sections for each of these.

Brief Description of System
An overview of the system, including any unique features and the name of the system publisher.

Program Where Observed
For this report, each publisher recommended the Washington program which provides the best utilization of the system, and the individual reports are based on observations of those programs. Information is included about student population, program size, staffing, and length of time system has been in place.

Cost Factors
In this report, cost information is intended for comparison and estimation purposes only. The design of the various systems with their individual elements means that this type of comparison should be used only to get a very general idea of the approximate cost. Publishers provided cost information for a typical eight-station lab with a teacher management station and software for an ABE/GED program. CNS provided information about their software modules, but not for hardware, since that must be purchased separately. CCP did provide comparative information, but the system can vary tremendously — a program would not have to have any student work stations if it utilized only print materials, or could choose to buy a wide range of instructional materials, including not only print but also computers, software, VCR's and videotapes, cassette recorders and tapes, language masters, etc.

Another cost consideration which is important for ABE programs, where funding is often problematic, is that most publishers have lease options for their systems, making it possible to fund an ILS over the course of several years.

Hardware
Most of the systems have more than one possible hardware configuration, and most have enough flexibility to allow the use of previously owned computers for student work stations if they are of the right type. In addition to a management station and student work stations, systems usually require a printer and some need extra components such as a speech synthesizer or an optical scanner.

Quality of System
Consideration should be given to the durability and quality of the hardware and software components as well as information about graphics and sound, sophistication of the instructional material, and quality of the system documentation manuals.

Assumptions about Learning
Questions to consider include whether the learning is student-managed or instructor-managed, whether instruction is computer-based or multi-resource, whether it is competency-based or norm-referenced, and whether instructional material is based on mastery of discrete items or integrates knowledge and transfers learning.

Instructional Design
Systems vary in their areas of instruction, question type, and clarity of learning objectives. The most important consideration in this section is whether learning objectives are presented sequentially, from a menu; or whether the system is capable of "branching" a student into review materials or more advanced materials, and of "spiraling" a student through objectives, introducing a topic and then returning to it for further instruction or review.

In a sequential presentation, a student would select, for example, a lesson on capitalization. The student would work on that unit until mastery was achieved, perhaps being given extra exercises if he or she were having difficulty, or perhaps simply repeating the lesson until it was mastered. Once the unit was complete, the student would probably not see further questions on capitalization unless there was a "section review" type of lesson.

In a branching, spiraled presentation, however, the student would simply choose to work on a general concept such as language arts, and capitalization would be presented at varying points within the curriculum, initially being introduced, then later being taught, and eventually being periodically reviewed. If the student had difficulty with capitalization, instructional tasks dealing with capitalization would continue to be woven into the presentation until the student consistently performed well, at which time it would be presented as a review concept.

Assessment/Placement
Some systems have built-in assessment and placement instruments which automatically measure a student's performance level and then move the student into appropriate instruction. Other systems require that the student complete a pre-test and that the instructor make assignments based on the pre-test performance. Additionally, systems have different ways of assessing student progress within the curriculum.

Instructional Delivery
This section is probably the longest in most of the reports. It includes general information about what curriculum materials are available, what types of instructional materials are used, and who the intended audience is. Then it looks at the particular instructional materials, how they provide instruction, and how effective they are.

Feedback
This is an important attribute of Integrated Learning Systems. They need to provide information to the student about his responses, correcting effectively when necessary and reinforcing correct responses. They vary widely in the sophistication of feedback provided.

Usability
This section considers how "user friendly" the system is, including the use of on-screen menus and directions, "bookmarks" to remember where the student stopped at the last session, the ability to review instructions, the level of typing skill needed, and the ease of generating a report. All systems examined were reasonably usable.

Modifiability
A number of parts of a system may or may not be modifiable. Some systems allow instructors to add instructional software or to reference other instructional materials. Most allow instructors to set the level of mastery or the rate of presentation, and some allow instructors to determine such things as whether students can pre-test out of a particular lesson or objective. Additionally, systems can be modified for use for other non-system purposes such as word processing or programming classes. It's important to recognize that a system which can be easily and extensively modified will then be limited in the amount of branching and spiraling (see Instructional Design, above) which it can do.

Management of Student Performance
Different systems have different ways of managing student performance. They have different criteria for mastery and different ways of reporting student results. Some systems have the option of re-arranging the objectives to match a particular course and eliminating unneeded parts of the curriculum or adding extra parts.

Records Management
Issues are how record keeping is done (by hand or by computer), what reports are available, how easy it is to use the records management system, and how many records can be maintained within the system.

Support/Service
An important consideration is how easy it is to get service when needed and what types of supports, such as additional staff training and a toll-free hotline, are available.

Staff and Student Response
When possible, staff and students were interviewed and asked very general questions about strengths and weaknesses of the system. It's important to remember that these responses are subjective and may or may not be accurate.

Section 4: INDIVIDUAL SYSTEM REPORTS

CCC SYSTEM

Brief Description of System
The CCC Instructional System is a product of the Computer Curriculum Corporation in Palo Alto, California. It is a "closed" system which uses only the software which has been integrated into that system. (An IBM-based system is also available, which makes the system more open, but precludes the use of remote sites.) There are two types of courses within the system — lessons courses and strand courses. In lessons courses, students master a set of objectives one by one. In strand courses, students select a curriculum area such as reading, writing, or math, and then work on a number of objectives which are interwoven. The strand courses are the more recently developed ones and are much more sophisticated in nearly every way than the lessons courses. Each work station has a mouse which can be used to manipulate on-screen tools (such as a ruler), draw lines, etc. Some unique features of CCC are that it can continuously adapt instruction to an individual learner's performance, can provide some parts of the ESL instruction in any one of six foreign languages, can predict how long it will take a student to reach a goal, can print out supplemental worksheets for a student based on that student's current study, and can be used for electronic mail, sending messages from the instructor to one or more students on the computer screen.

Program Where Observed
CCC was observed at the Washington Institute of Applied Technology. It has been in place six months, and is used with 40 out-of-school youth and 40 adults daily. It is used as the sole provider of basic skills instruction. Students spend about 1 hour daily on the system, then may use other hardware (Macs and Apple II's) and non-system software. WIAT screens students upon entry into one of three categories according to their performance on the TABE: students with an 8.5+ grade level go directly into a vocational class, students with 6.5-8.5 work on the CCC system concurrent with vocational program enrollment, and students with levels below 6.5 are assigned only to the learning center and the CCC system. The Learning Center is staffed by a system manager, a GED instructor, and an instructional aide.

Cost Factors
The estimated cost for 8 work stations, all necessary hardware (Atari work stations), a selection of basic skills software, and set-up and training is about $53,000. It is possible to purchase fewer or more modules and different hardware options, thereby affecting the cost. Both the software and hardware components can be easily expanded. If a Microhost is used as the file server, it can support up to 128 stations (including remotes connected by modem). Also available at extra cost are peripherals such as a speech synthesizer and graphics server.

Hardware
CCC can utilize a variety of computer types, including IBM, Atari, and (with some courseware limitations) Apple IIe and IIgs. Some of the courseware requires color monitors and graphics capability, so this must be considered in making hardware decisions. The file server control unit has a 128 megabyte hard drive with a Unix operating system which can control up to 128 work stations, including remote sites, and can hold 5,000 individual records at one time. The system uses RGB graphics and a Unix-based Microhost speech synthesizer. Each work station has a mouse, so that students can use pull-down menus and icons.

Another option which is available is an IBM I-platform control unit. The choice of this option means that any DOS software can be listed on the menu, but it also means that the control unit cannot service remote sites.

An interesting option which has recently become available is something called the SOLO (Stand-alone Option for Learning Opportunity). This is a single 286 IBM PS/2 which has audio and all of the ABE, GED, and ESL curriculum modules installed on a CD-ROM (compact disk). The current cost of the SOLO is $6280.

Quality of System
The software falls into two categories: strand courses and lesson courses. The quality level of these two courses differs greatly. The strand courses use sophisticated color graphics, a mouse, help icons, and, in some cases, audio. The lesson courses use none of these. The strand courses have attractive, easy to read screens with white backgrounds and color images. The lesson courses have black backgrounds with white letters which can be difficult to read.

The graphics, when used, are sometimes slightly juvenile (monkeys and alligators) but not really offensive for adult learners. The audio, when used, is adequate rather than outstanding. Generally the content is accurate and free of "bugs" and errors, although an instructor commented that toward the upper end of the curriculum, there are occasional problems with screens "freezing" or not accepting student answers.

The system documentation is well done, well organized, and easily used by a trained user of the system. It is unlikely that an update would destroy student records, but WIAT recommends doing a back-up of student records and re-installing after the update on the remote chance that the update could have an effect.

The Microhost system has the reputation of being very stable, and the hardware is of high quality.

Assumptions about Learning
CCC is a computer-based system, rather than multi-resource. Students who cannot or will not use a computer would not be able to use the system. It is a competency-based system, in which learners progress by mastering competencies rather than achieving a norm-referenced performance level. In the lessons courses, these competencies are taught and tested discretely, with no real provision for integration of knowledge or transfer of learning. The strands courses, however, use a more integrated approach. As a student moves through a strand course, different competencies are woven together, and previously taught competencies are reviewed. The use of such on-screen tools as a thermometer or a ruler increase the likelihood that learning can be transferred. Because of the integrated nature of the strands courses, a learner simply selects the area for study (such as reading or math) but cannot choose a specific lesson. In the lessons courses, a learner sees a menu and selects the lesson. Learners can be given varying degrees of control over the sequencing of lessons courses and, if given total control, could complete the lessons in random order.

Instructional Design
The "lessons" courses are similar to stand-alone CAI. The presentation is sequential, with movement through the curriculum based on mastery objective by objective. Although learner objectives are not stated directly, the purpose is defined and students generally know what is expected of them. Questions are almost exclusively multiple choice.

The "strand" courses have much more complex branching. The presentation is sequential, but there is frequent review and constant adjustment according to student performance. Question types are highly varied.

The system is able to provide instruction in K-12 and ABE math, reading, and language arts; secondary-level math, reading, language arts, and computer science; GED preparation; and ESL with instructions provided in Hmong, Spanish, Japanese, Mandarin Chinese, Arabic, or Italian.

Assessment/Placement
Students can be placed into courses such as math or reading or writing by grade level or by objectives to be completed. In either case, diagnosis is done outside of the system (WIAT uses the TABE) and initial placement into the system is done manually. The instructor assigns courses for each entering student, up to a maximum of five courses per student. The instructor has the flexibility either to program a sequence or to override the sequencing and let the student choose the order. The instructor can also omit certain lessons from a course.

In the strand courses, the system then goes through an "Initial Placement Motion." This means that student performance is closely monitored and the computer gradually "narrows in" on the student's actual level of

performance. Lessons courses are usually assigned based on a student's need to complete the objectives within those courses, and so the student simply moves through the objectives sequentially.

A unique feature of the CCC system is its Individualized Prescription Strategy (IPS). If this optional component is purchased (for about $10,000), the system will monitor student performance, compare it with the corporation's years of data, and project and provide a continuously updated estimate of the amount of CAI time a student will need to reach his or her stated goal.

The assessment of progress is a continuous process in the strands courses, with the system constantly adjusting the level of material to meet the student's current need. Another unique feature of the CCC system is that mastery is not just percent correct, but also amount of time spent on each question. In most systems, a student who can answer four of five questions correctly, for example, would be considered to have mastered the skill even if he or she took more than an hour to answer those four questions. Mastery in CCC means that the student has achieved the necessary percentage correct and has done it within the time limits.

WIAT has observed that students generally are gaining one month in grade level in reading or math for every two hours on the system. A Louisiana study with high risk students age 14 and above showed an average gain of 1.5 grade levels after 15 hours of CAI math and 1.2 grade levels after 14 hours of CAI reading.

Instructional Delivery

The CCC System includes 665 hours of mathematics instruction, 50 hours of "survival skills," 80 hours of GED Preparation, 467 hours of reading (some with a speech component which require the optional speech synthesizer), 445 hours of spelling and writing, 10 hours of keyboard skills, and 310 hours of computer programming in courses which CCC considers appropriate for adults, but which would not be a part of a basic skills curriculum. Additionally, there is a 35 hour "reading readiness" program which is not listed as an adult course, but which looks as though it could be useful with non-readers. About 2/3 of the math and reading courses, those at the lower levels, are "strand" type, and upper level math and reading and GED Preparation are the "lesson" courses. The curriculum materials are revised yearly, and more strand courses are gradually being introduced.

As the CCC Competencies are similar in many cases to the Washington State Core Competencies Curriculum, CCC could be useful for Washington ABE programs. It would be difficult to integrate completely, however, since specific competencies and objectives cannot be isolated in the Strands courses, which are a majority of the curriculum at the lower levels. The materials targeted specifically for the GED are not nearly as complete, and typically require the student to read a passage from the CCC GED text, then complete on-screen questions. The GED course does reflect the content of the 1988 GED, and there are on-screen practice tests available. A word processor and writing tutorial seem appropriate for GED level students. The ESL curriculum has a unique feature — it provides spoken instructions in Spanish, Mandarin Chinese, Arabic, Italian, Hmong, and Japanese. Minimal reading skills are assumed.

The delivery system is exclusively CAI, with the exception of the auxiliary textbook used in the GED course. In the strand courses, it does a wonderful job of taking advantage of the computer's capabilities. The materials were developed exclusively for the CCC system and are periodically updated.

A feature of the CCC system which seems as though it would be particularly useful is its ability to generate and print worksheets for individual students or for a group, based on current areas of difficulty. This is done through a teacher menu which gives the teacher alternatives such as answers, no answers, odd answers only, or answers printed on a separate sheet.

The bookmark feature which takes the student back into the lesson at the place last completed makes it easy for a student to work on the system for any increment of time. Students can select the curriculum area they wish to work on and can alternate within a session between areas such as math and spelling, etc. However, because of the nature of the strand courses, moving backwards within a lesson or repeating when desired is usually not possible.

When a new concept is being introduced, or when a student is having difficulty with a concept, a Help icon becomes active. Choosing this icon leads to a tutorial on the concept being studied.

No discrepancies were noted between level of instructions and actual instructional material, and programs seem appropriate for adults (with a minor concern about some graphics — see Quality of System, above.)

In the strand courses, not only question type but also question topic varies. For example, a student in a math course might have one question about adding decimals, then the next question could require application of the skill in an area such as measurement, then back to decimals. Question types include typing in an answer, or using a pointer to choose an answer, or drawing a line between matching answers, and so on. In some cases, "tools" such as rulers are available. A student can move the ruler around the screen to measure various on-screen objects. Review questions are also incorporated. This variety of presentation undoubtedly adds to student interest levels.

Feedback

A correct answer usually generates a graphic reward — a blue, red, or green ribbon, depending on the length of time and number of tries required to reach the answer. An incorrect answer gets a hint, such as "Re-read the first sentence of the paragraph," and a message to try again; a second incorrect answer is followed by the correct answer. In language, when an answer was supplied without the necessary capital letter, the system prompted, "The L needs to be capitalized." In math, any digits which are supplied by the system are in red, while digits supplied by the student are in black. There is usually a "Help" icon available, which will give the student either a hint or the correct answer. These types of feedback are immediate and always have a positive tone.

At the end of a session, students are given a graphic display of their current performance level; usually a "thermometer" with the performance level displayed.

Usability

Although implementing the system requires little knowledge of computers, it is so complex that training is vital. In order to use it effectively, an instructor or lab manager would need not only the company-supplied training but also a few days without students in order to become familiar with its operation.

Orienting a student to the system is less complex. It requires about 1/2 hour to become familiar with the function keys and the overall format. There is a handbook, which WIAT is considering re-writing at a level appropriate for student use. Some of the programs at the beginning levels have orientation to computer use.

In lessons courses, the instructional system begins with a menu. In the strand courses, the system automatically enters a student at the beginning of the next objective to be mastered. In order to return to the menu, a student must exit the course. Most of the courses have on-screen directions which can be accessed either with a keystroke or by pointing the mouse to the "owl" icon. It's not always possible to repeat screens or to review instructions, but in some cases there are on-screen directions to enable the student to do that. Help is available in some courses, usually the strand courses, and when it is available, the "help" icon is present.

A bookmark feature returns the student to the lesson which he is currently working on.

Modifiability

In order to have new software be a part of the instructional system, it would have to be re-programmed, a process which would be difficult, if not impossible, for most sites. It is simpler just to disconnect (a simple task) the workstation from the system and use it as a stand-alone. WIAT uses non-system Macs and Apple IIe's for students to use when working on non-system software. If a program wishes to use the work stations for non-system software for something like a supplemental word processing class, it only requires a simple disconnection at each work station.

It isn't possible to change the level required for mastery, which includes not only percentage correct, but rate

at which a student completes a task. Instead, an instructor would change the student assignment to a higher or lower grade level.

Management of Student Performance
The strand courses have a highly sophisticated system for managing student performance. Initial assessment (see Assessment/Placement) involves an initial placement motion which monitors a student's first 100 minutes on the system closely in order to determine correct placement. Then continued progress through the system is dependent upon student performance, continually being adjusted up and down, depending not only on number correct, but also on length of time needed for each answer. Because progress is a continuous movement rather than a series of steps forward, it can be difficult for a student to recognize progress. To combat this, students need to receive regular progress reports from the instructor.

While strands courses have a continuous process of branching a student through the curriculum based on performance, lessons courses are more standard — students complete a pretest, tutorial, and posttest for each objective. If mastery is not achieved, the instructor needs to intervene and provide alternative instruction.

Students are assigned only those parts of the curriculum which will meet their needs, up to a maximum of five courses at any one time. Unneeded areas of the curriculum can be eliminated on an individual assignment basis.

If a student or a program wishes to have a prediction about the length of time that will be needed to reach a stated goal, the optional IPS module (see Assessment/Placement) can provide that information.

Records Management
CCC provides three types of reports which summarize current performance and progress. A **course** report gives detailed information about the student's activity during the most recent session, a **grouping** report highlights areas where the student is experiencing difficulty (which can be used to group students with similar difficulties), and a **gains** report (strand courses only)
summarizes student gains in level since placement and in the most recent 20 sessions. The gains report can also be requested for a group of students to show the mean gain and time spent.

The management system is rigidly structured and does not allow for alternative formats or provide other types of reports, such as scheduling or attendance. These institutional requirements would have to be completed in another way.

Adding, deleting, or printing student records can be done easily from the teacher menu, but once an item is entered, it's necessary to begin the routine again in order to change that item. These functions are menu-driven and, once the codes and curriculum are learned, easy to do.

Anyone who has the necessary codes and passwords could alter or delete records. For this reason, passwords can easily be changed and CCC recommends that this be done frequently.

One central file server control unit can serve up to 128 work stations, including remote sites connected by modem. It's also possible for a central office to be connected by modem to schools with CCC systems in order to monitor student performance reports.

Support/Service
CCC has a hotline, which has been very helpful to the WIAT Learning Center. There are also local technicians available when necessary. WIAT initially had some set-up problems, but they have been resolved satisfactorily. Additionally, a weekend power outage caused the system to crash, but it took only about half an hour of telephone assistance on Monday morning to get back on line.

Staff training is provided with purchase and is available on an on-going basis as a part of the licensing

agreement, but may not be needed. There is no user support group or conference schedule.

Student Reactions
Students interviewed had mostly positive reactions to the CCC system. They like the detailed instruction, the fact that learning keyboarding skills is a "bonus," and the speed at which progress is made. Two students complained that occasionally the computer doesn't seem to recognize a correct answer, or that the same lesson is repeated. It wasn't possible to *verify* whether these were legitimate concerns or a reflection of the students' difficulty understanding some of the lessons.

Staff Reactions
Instructors are excited about the system. They appreciate the reports available, especially the grouping reports which make it easier to organize small group instruction. One instructor regularly takes advantage of the provision for sending "electronic mail" to a student — when the student begins a session, he/she receives a "message waiting" signal, and finds a message of encouragement from the instructor.

Only two negative comments were made — that the strand reading courses top out at about a 7.5 grade level (there are lessons courses available for higher grade levels), and that at the upper end of the curriculum, there are some minor system problems.

CCP SYSTEM

Brief Description of System
CCP, The Comprehensive Competencies Program, is distributed by U.S. BASICS, the United States Basic Skills Investment Corporation, of Alexandria, Virginia. It varies significantly from other large-scale Integrated Learning Systems in that it is primarily a learning management system which references a large number of materials and a variety of media, including textbooks, workbooks, cassette tapes, and videos in addition to software.

On the CCP system, a student takes a paper/pencil pretest which is scanned, and a diagnostic profile of strengths and weaknesses is printed out. The student and teacher then conference to determine priority areas of study and the teacher makes assignments using the CCP list of recommended materials. After completing these assignments, the student takes a paper/pencil test which is again scanned and progress sheets are printed out.

U.S. Basics is a not-for-profit corporation, funded primarily by the Charles Stewart Mott, UPS, and Ford Foundations. Potential users may choose to prepare and submit a formal application to U.S. Basics to be approved as a BASICS Center for continuing program support and participation in regional training activities, or to purchase the system outright. For collaboration members, program effectiveness is monitored through quarterly reviews, and annual renewal of the CCP franchise requires that performance standards are maintained.

CCP released a newly designed system, using an IBM management station with a hard drive, in late spring 1990, just as the final report of this project was being prepared. It is the earlier version of CCP which was examined for this project, and upon which most of the comments are based. This earlier version is no longer available for purchase, and U.S. BASICS feels that their new system has many advantages over the old. The basic program design has not changed, however, only those aspects which relate directly to the use of a hard drive rather than floppy disks.

Program Where Observed
CCP was observed at Skagit Valley College, where the system has been in place 2 1/2 years, serving 80 ABE, GED, and Developmental Ed. students each quarter. The CCP system provides the overall structure, but Skagit Valley supplements it with individual tutoring and non-CCP materials. An instructor does most of the

monitoring of student performance and supplemental instruction, and a half time clerical aide does the data entry and test scanning. The learning center has six student computers, which are used to provide about 5-10% of the instruction.

Cost Factors
Information about a typical CCP lab purchase was provided. This "typical" lab consisted of a management station with necessary software, 5 student work stations with $9,000 worth of software, 3 VHS recorders/players, 5 audiocassette players, and appropriate instructional audiocassettes and videotapes, a library of print materials (2-8 copies of each title), and the implementation/training package. Such a typical lab would cost approximately $49,000. Because many of the materials which are referenced by the CCP system are those which are very common in adult education, many programs may find that they already own some of what is needed. That equipment and those materials which are not already owned may be purchased either from U.S. BASICS or from other vendors and publishers. In 1989, purchases from U.S. BASICS ranged from $10,000 to $100,000 with the average purchase roughly $35,000. The annual user fee is $1,000 for members of the collaboration, but for that user fee U.S. BASICS provides not only support but also $1000 in coupons which can be used to cover up to 25% of the price of additionally purchased equipment or materials.

Hardware
The hardware utilized for the management workstation has been either an Apple IIe with three disk drives or an AppleSider hard drive. New systems utilize an IBM with a hard drive. If available, a modem can be used for communication with U.S. BASICS' bulletin board. Some of the newer instructional software in the system requires color monitors, so they would be preferred if a program is acquiring new hardware. Because the student work stations are not networked or integrated with the management workstation, the type of student computers used is more dependent upon the software chosen than on the CCP management system.

Quality of System
The Apple IIe with floppy disks can be inconvenient and the AppleSider hard drive has been unsatisfactory in several early installations. U.S. BASICS has converted to an IBM hard drive, which they hope will prove simpler and more reliable than either of the previous options.

A major criticism of CCP is that some of the material is badly out of date. New modules are being added, but the older modules are still available, which may contribute to this impression. There is a regularly-published list of new materials, but many of the books which are referenced in original modules have publication dates of 1975 and earlier, and much of the software was developed more than ten years ago.

The system documentation remains wordy and difficult to use, although it has improved somewhat. Some centers have had minor problems with their Apple management software.

Some programs may choose to use already owned hardware and software, which will of course be a significant factor in the quality of the system. The scanner at Skagit Valley, used for scoring student tests, has occasionally needed replacement, some of the computer disk drives are rather balky, and some software has "crashed."

Assumptions about Learning
CCP is a multi-media system with an eclectic instructional approach because of its use of a variety of media and materials. It is the only system of the five which would be appropriate for use with learners who are unable or unwilling to use a computer. CCP uses a "clinical" approach, with assessment, diagnosis, prescription, and follow-up testing. It is a competency-based system, in which learners progress by mastering competencies, and this progress is cross-checked with GED practice tests and/or TABE tests. Learner objectives are not always clearly spelled out in terms of individual objectives, although students know the topic and the requirements of the unit and mastery tests. Learners then take responsibility for finding instructional materials by reference number, completing the learning activities, and tracking their own time and assignments. It would be possible to complete objectives in any order desired, which could defeat the "building block" approach of mastering simple skills before attempting complex ones. Because one compe-

tency might require the use of several different instructional materials, integration of knowledge and transfer of learning are probably higher than in a strictly CAI system, depending upon the particular materials used.

It is possible to identify and teach specific isolated competencies, should that be desirable.

Instructional Design

Identified areas of instruction are functional literacy and academic subjects for Developmental Ed., GED, and ESL students. Within each component, there are three tiers: Basic, Intermediate, and Advanced. An individual student's prescription is based on his performance on a pretest. A test can be taken at any time and is scored by scanner, then the instructor and student must review the results and determine whether the student should move to the next unit or whether the current unit needs review. U.S. BASICS recommends 80% for mastery, but the instructor makes the determination of whether the student has in fact mastered the competencies or not.

Assessment/Placement

The TABE and the GED Pre-tests are used for diagnosis and placement. Tests are taken with paper and pencil, then answers are scanned into the system. The system can do a diagnostic profile for TABE results which indicates grade level equivalence in each subject and predicted GED scores. The TABE is not considered useful by most programs as an assessment tool for either ESL students or beginning readers, so U.S.BASICS does not require the use of the TABE with these populations.

When a new student begins, s/he must complete approximately one to three hours of testing with the TABE, depending upon the battery of tests used. Following that, the instructor and student spend about ten minutes determining which areas will be studied and the instructor makes assignments. New students are also given an orientation to the system which takes about ten minutes.

At the end of each unit, a student takes a paper/pencil multiple choice test provided by U.S. BASICS. In general, these assessments do a good job of measuring the skills which have been taught. Test answers are scanned and recorded by the computer.

Skagit Valley College has documented an increase of about four grade levels for each 100 hours on the system in a given curriculum area. A 1989 U.S. BASICS study showed a 1.3 grade level gain in reading or math after 33 hours of study. A Skagit Valley staff member speculated that one possible reason for their higher rate of increase is that some of their students are relearning fairly strong basic skills and require only a quick review before post-testing.

Instructional Delivery

The system includes a range of skills and skill levels, from reading readiness through high school/GED and life skills competencies. There are 20 subjects in Developmental Ed/GED and three subjects in ESL. Having such a broad range, CCP includes many of the competencies from the Washington Core Competencies Curriculum.

Instruction is delivered using a variety of materials including paper/pencil, videos, audio cassettes, computers, and language card readers for ESL. Tutoring, lecture, and discussion could also be integrated into the system. Instructional material at the lower levels seems designed for children and is largely inappropriate for adults. The reading curriculum is not effective for Level 1 ABE students, according to the Skagit Valley staff, and there are no Level 1 writing materials.

The amount of time spent with the computer depends upon the subject and upon student choice; it could even be none. Actual instruction is primarily through print; the computer-assisted portion of the curriculum is almost exclusively drill and practice. *[U.S. BASICS feels that this is not the case with their newer CAI]* Some of the reading materials and the newer GED materials do emphasize higher-order thinking skills. The materials used are a collection of programs and materials from various publishers. This use of material from a variety of sources can be problematic; not all of the materials sequence skills identically, so a student may

encounter information which incorrectly assumes prior knowledge. There are worksheets available which could be duplicated for homework assignments, although they were not created specifically for that purpose.

Because instruction is delivered in a variety of ways, the length of a unit varies tremendously, but generally the units are of appropriate length, and time and instruction between tests is appropriate. Students see their progress when noting scores on individual assignments and unit tests.

Feedback
Feedback for individual assignments depends upon the materials being used. With standard print, video, or cassette, the student uses answer keys to discover whether his work is correct. In the software programs, the level of feedback depends on the particular program being used, but is generally of the "No," or "That's right!" variety, sometimes with hints or answers.

Feedback after testing can be immediate, depending only on the ability of the staff to put the completed answer sheet through the scanner. Once answer sheets have been scanned, students can see their % correct and which questions were missed, and students and teachers can review missed answers to plan remediation.

Usability
The overall program is complex enough that it would require extensive training or experience to implement and manage. However, the management system is menu-driven and user friendly and requires little or no actual computer knowledge. Reports can easily be generated and results are automatically printed out. Test answers are marked on scannable answer sheets which are then scanned and the responses automatically recorded and tallied. It is possible to use the system for attendance, but in order to do that it has been necessary to dedicate a computer with a time card to that purpose only. *[That's no longer true with the IBM system.]*

The computer-assisted instructional materials sometimes experience delays which can frustrate students, and the management system could be faster. The system examined ran on three Apple floppy disks; the IBM hard-drive system should be much faster.

With the floppy disk system, student records are completely separate from the management system, so are unaffected in the case of an update. This may change with the advent of a hard drive system.

Modifiability
New student materials could be referenced into lesson assignments, which is not a difficult task, but it could be a lengthy one. If a program had a favorite assignment to teach charts and graphs, for example, it would be easy to enter that under one competency, but it would be difficult to incorporate a new reading series because every objective being taught would have to be analyzed and entered under the appropriate competency. This is the reason that the Skagit Valley program often elects to bypass the system when they are using materials which are not already referenced. If other objectives need to be added to the curriculum, there is a process which makes it possible. The process is not difficult, but is lengthy, as it would be necessary to enter all resources and test answers. It would be possible to "repackage" certain objectives as a separate course, but would be easier just to assign a student certain units or subjects. (Although mastery tests include items for all objectives in a unit, not just selected ones.)

Management of Student Performance
It's possible and usual to assign only some of the objectives to a given student. Unneeded areas of the curriculum are simply not assigned. Movement through the curriculum is based largely on teacher discretion. The system reports % correct. and the instructor can decide what % to accept, but U.S. BASICS recommends at least 80% for CCP reporting. There are two versions of each paper/pencil test. If a student does not receive a test score which the teacher feels is adequate, the teacher reviews the errors with the student and makes further assignments from a list of supplemental materials or assigns a review of the core material.

Records Management
Student performance on individual assignments is not tracked on the management system. The system tracks student performance by scanning test answer sheets for unit, level, and subject mastery tests, including number correct and which specific questions were missed. Test scores may easily be printed and compared with previous reports, but the computer does not make a comparison. Deleting and changing records is simple, although not really needed, because tests may be taken as many times as necessary. Completion information on a student is entered manually.

The system will also report student hours and grade gain by subject area at 100 hour increments and/or upon exit, although with the Apple management system the data must be entered manually unless there is a computer dedicated to attendance.

CCP users collect and report on program data as well, including staff costs, open hours, student/staff ratio, and costs per learner hour. Additionally, it can collect and report on student demographic data. However, all of the information must be collected and recorded manually. In the past, U.S. BASICS has required by contract that this information must be compiled and reported to the corporation on a quarterly basis. They are now allowing programs to choose whether to join the BASICS collaboration and participate in the data collection process or simply purchase the system without such regulation, supervision, and support.

If students have the teacher code, it's possible for them to access the management system. This teacher code is easily changeable.

Support/Service
U.S. Basics has always required a quarterly report, although they are now making it optional (see Records Management). The new quarterly report form is just one page. Production of the quarterly report involves gathering financial information and information about staff hours, making sure that student records are up to date, and running an analysis. The most time-consuming part of generating the report is keeping the participant records current.

There is a users' support group and U.S. Basics holds regular regional and national conferences. There is also an 800-hotline for technical support. The system at Skagit has required very little technical service.

Six days of training for lab staff is required by U.S. BASICS before a program can be approved as a Basic Skills Investment Center. If an approved center is having difficulty, U.S. BASICS requires that the program hire a certified technical assistance agent to provide further formal training.

Student Reactions
Five students were interviewed. Their likes include the speed of feedback from diagnostic and unit tests, the individual nature of the program, the variety of materials used, and the ability to re-take tests as many times as needed. Minor dislikes include software which runs too slowly, often shows a blank screen, and has inappropriate graphics.

Staff Reactions
The program administrator is very pleased with the CCP system, saying that it lives up to its promises. He points out that the detailed record-keeping, while it can be seen as a burden, can also be a benefit. Skagit has been able to use the statistics generated in successful grant applications. The staff training requirement, also a potential burden, insures that the center is operated by a qualified person. U.S. BASICS insures that programs which are certified as Basic Skills Investment Centers maintain quality programs, so that those centers have the credibility provided by national certification.

Instructors view the system as being very versatile and able to meet a variety of student needs, including some computer familiarization. They are pleased that it allows immediate feedback without teacher involvement. They have received prompt and helpful technical support and appreciate the user support group. On the other hand, they feel that some of the materials are not as well done as they should be, and they regu-

larly use non-system materials to teach certain skills. The record-keeping is sometimes a burden, although it has become more streamlined. They feel that the lower level reading materials are not age appropriate.

CLASSWORKS SYSTEM

Brief Description of System
ClassWorks, published by Computer Networking Specialists (CNS) in Walla Walla, differs from the PLATO, WICAT, and CCC systems in that it is primarily a management system for an assortment of software from various publishers such as Hartley, Milliken, Random House, and Educational Activities. This system organizes the various programs and reports student performance and progress. It is an open system; software which can be added to the system is limited only by the ability of the corporation to acquire the rights to do so and by the hardware needed to support it, but it must be added by the corporation, not by an individual program or instructor. ClassWorks uses a Local Area Network,with an Apple IIe or IIGS as the master computer, and was designed to be similar to AppleWorks. Purchasers of the system are not buying unique software, they are buying a software management tool, a variety of courseware organized into meaningful assignments, and the capacity to track and document student progress.

Program Where Observed
ClassWorks was observed at the Thurston County Youth Service Center in Tumwater. This is a juvenile correctional facility, which has about fifty students using the system on a daily basis. They have had the system in place for five months, after a trial period of about one month. Most students using the system are earning credits for a return to the home school district. Students are on the system for a one hour block of time each day as one part of the educational activities provided. They currently use only the math and language arts portions of the system.

Cost Factors
The cost of the system can vary widely, depending upon the amount and type of hardware purchased and the number of curriculum modules purchased. There is room for flexibility in making purchasing decisions. It's possible to use already-owned Apple IIe's or IIgs's (not IIc), or IBM's, which would substantially reduce the cost of acquiring hardware. Otherwise, it's necessary to purchase the desired number of student stations, a teacher station with a hard drive, and curriculum modules. Prices below are for the management system software, the hard drive, and the instructional software, not the computers or printer. The least expensive ABE software curriculum module is $21,700 and the most expensive is $43,600. If a program decides to upgrade to the more expensive module at any time, the cost of the original module is applied toward the cost of the upgrade. GED curriculum modules range from $14,100 to $56,500. There is an optional annual service and upgrade fee which is about $1000. There are rental and lease-to-purchase programs.

Hardware
The system can support up to 40 student stations, using Apple II's (48K), IBM's, or MS-DOS machines. The cost of the overall system will depend to a great extent upon the type of student station selected. ClassWorks requires one Apple IIe or IIgs with 128K and two 5 1/4" disk drives, a Local Area Network(LAN) with a hard drive, and a printer. If the basic reading program is selected, a SuperTalker will be required.

The operating system is DOS 3.3. There is no real remote capability, although it is possible to locate student work stations as far as 4000 feet away from the management station. Student workstations do not have graphics interaction capability with the use of a mouse.

Quality of System
There have been problems with networks in the past which CNS feels have been solved. They say that the particular hard drive they are using has been available for a long time and is very durable.

Most of the software lessons observed were at least five years old. In most cases, the subject matter has not

changed, but advances in programming have made newer programs much more sophisticated in terms of branching, help menus, and feedback after an answer. However, because the software has been used for several years, it generally is free of "bugs" as well as grammar, spelling, punctuation, and usage errors.

The system can run with either color or monochrome monitors. The systems which were examined had color monitors. While these are generally more attractive, in several instances the print on screen was very difficult to read.

Some of the graphics observed are only marginally acceptable for use in adult programs. The Hartley programs, for example, are exclusively drill and practice, and use "happy faces" with wiggling ears as a reward for a correct answer. Most of the programs do not use audio except for "beeps" which can be turned off. The basic reading program does have sound which, while understandable, is not really clear.

Assumptions about Learning

ClassWorks is a computer-based system, rather than multi-resource. Students who cannot or will not use a computer would not be able to use the system. It is a competency-based system, in which learners progress by mastering competencies rather than achieving a norm-referenced performance level. These competencies are taught and tested discretely, with little provision for integration of knowledge or transfer of learning.

The system is programmed to present simple concepts before complex ones, but because of the use of software from different companies the sequence is not always completely linear and a particular piece of software may incorrectly assume prior knowledge or may repeat concepts taught in another piece of software. Students have relatively easy access to a menu which allows them to see their records or to change to another subject, but they have no control over the order of lessons within a subject.

Instructional Design

Skills are taught sequentially. If a learner fails to master a lesson, a second (and sometimes third or fourth) lesson on that same competency is automatically assigned. The reading component provides basic phonics instruction as well as reading practice.The math programs observed were primarily drill and practice. Questions in many of the lessons observed were multiple choice .

ClassWorks lessons can be sequenced to match specific curriculum guidelines, such as the Washington State Core Competencies Curriculum. The breadth of the available curriculum makes it possible to find instructional materials for many of the identified ABE and GED competencies. The ABE language component has some material which would be usable with some of the ESL competencies.

Assessment/Placement

There is no actual placement test which is a part of the system, so that most programs will use a test such as TABE or CASAS to identify student learning objectives. Within ClassWorks, it is possible to select a mode which will give a new student an "overview" lesson in each subject selected and will record those objectives which were missed, then cycle him or her through the lessons for those objectives. This placement process would be inappropriate for beginning readers or low-level ESL students because they would likely be unable to complete any objectives correctly and might become discouraged. It would probably be preferable to simply assign them all lessons.

Progress is assessed by tracking mastery of lessons. Within a lesson, progress is sometimes shown graphically, for example, with checks in boxes or bar graphs. Progress records are readily available to teacher and student.

CNS indicates that ClassWorks produces 20-30% improvement over other instructional methods (not other CAI programs). A JTPA program in Kitsap County showed an increase of 2 grade levels in reading and math after 8 weeks. Programs observed had done no studies comparing or measuring student performance.

Instructional Delivery
CNS has available more than 1500 software programs from over 30 publishers. They are also willing to discuss customizing their pre-packaged modules to suit the needs of a particular program, but sometimes that possibility depends upon their ability to obtain rights to the desired programs.

CNS has targeted ABE and GED students, and the system would be usable with a range of these students, from low-level ABE to GED and, to some extent, Developmental Ed. Additionally, there are life skills lessons, vocational education sequences, keyboarding, and word processing programs available. It has limited applicability to ESL students. There are some concerns with the appropriateness of the software for use with adults (see Quality of System.)

It's difficult to address the question of whether the system takes advantage of the computer's capabilities, since that strongly depends upon which of the many software programs is being examined. However, there is a preponderance of drill and practice programs with multiple choice questions and limited branching or review.

The units of instruction, called lessons, are well within the limits of a student's attention span, ranging from a minute or two to about 20 minutes in length . A few of the lessons give the student an estimate of the length of time it will take him to complete the lesson. If a student should exit the system during a lesson, the results from that one lesson are not recorded and the student will begin that lesson again at the beginning of the next session. Because of the variety of publishers, there is a tremendous variety in presentation and question type. This is an advantage in that a student who does not find one lesson helpful can try other lessons with other approaches. It's a disadvantage in that there isn't a standard format, so that a student needs to adjust to each new type of presentation and question. Most of the lessons seem to have sufficient exposure and opportunity for practice. However, most of the programs have a pre-determined sequence so that a student who is doing well and a student who is doing poorly will be given equal numbers of problems.

Few of the lessons are sophisticated enough to prevent guessing or random answering, but if it leads to a poor score, that will be reflected on the student report. In the case of one language program, the correct answer for every question in a sequence of ten questions was "b." The number of trials in most lessons is two or three and in some of the lessons, hints are given after incorrect responses.

As mentioned above, there is no provision within a lesson for automatic branching to adjust difficulty levels or sequence according to student performance, and there are no review questions. The system attempts to provide this type of branching and review by controlling the student's progress sequence. Usually, if a student has an extremely low score on a particular lesson, he is directed to "See the teacher" or to repeat the lesson. If the score is low but above a failing level, the student may be given a second lesson on the same topic. If the student achieves a mastery score, he is given a lesson in a new topic.

Higher-order thinking skills do not seem to be addressed by most of the software programs in the system, although the programs observed were primarily at a low level.

Feedback
The feedback given for correct and incorrect answers depends on the particular lesson. It frequently seems limited to "That's right!" or "No" type answers. Some of the language programs did provide "hints" after an incorrect response and a request that the student try again.

Feedback in all observed cases was prompt and did not threaten learners or reward incorrect responses. For some lessons, it was also corrective and informative. Because of the variety of software programs used, there is a variety of types of feedback, so that it does not become boring.

Usability
Instructors and students need little computer knowledge to use the system. Of course, before the system can be implemented, training is needed for staff who will be using it, and that training is provided with the

purchase. Subsequent training necessitated by staff turnover can probably be provided on the job by other staff who are familiar with the system. Both instructional and management systems begin with a menu, and all teacher tasks can be selected from various menus.

A student can easily return to the menu at any time and choose either to see his score or move to another subject, but if he exits a lesson before completing it, the records for that lesson are lost and he must begin it again at the next session. It is generally not possible for a student to review instructions and previous frames of a lesson without exiting the lesson and beginning again.

Very few of the programs have help screens available. The pace of the lessons observed was tedious: the computer responded slowly to the keyboard, there was a lengthy delay at the start of lessons, and there was a wait of several seconds between screens.

Instructors can generate reports from a menu. The instructor screens are prompt and printing can be done without delay.

Modifiability

There is a good deal of flexibility within the scope of the curriculum which CNS has available. Software from their "library" can be added (and in some cases, may necessitate an adjustment in cost.) An instructor cannot add software to the management system, however; that must be done by the CNS programmers. Networkable software can be loaded onto the hard drive which can then be accessed through the network but not managed by ClassWorks. Also, a two-stroke command will take a student off the network to use the disk drive with other software.

Student performance parameters such as rate or mastery level generally have a default setting, but that can be changed by an instructor through the teacher menu.

Management of Student Performance

Up to 2000 students can each be enrolled in up to 9 different classes, with space for 50 lesson results and 10 individual data summaries per class. Up to 400 skill objectives may be chosen for classes or individual students or may be automatically programmed on the basis of pretest performance.

Unneeded areas of the curriculum may be eliminated and others added, within the ClassWorks "library" of programs. It is possible to select certain objectives and "repackage" them as a separate course. The instructor can set mastery levels from the teacher menu or accept the default level for mastery. In both cases, mastery is equated with a percentage, not with time. The system does, however, record the amount of time a student takes to complete a lesson.

Objectives are taught with the use of several different software programs from different publishers. Students see a menu which lists the objectives (not the specific software programs) they must master. Movement through that menu is based on mastery. If the "advance flag" is set, and a student masters the first lesson for an objective, the system advances to the next assigned objective. If the student fails to master the first lesson, he will proceed through the lessons in the objective. If the "review flag" is set, a student who has difficulty will be assigned a review lesson.

Records Management

Reports available are : assignment results (% correct and time on a lesson), class roster, class status, class summaries, mastered objectives, and objective range (range of mastered assignment objectives.) A student mastery matrix can be viewed by students to increase motivation. There is no formal means for tracking demographic data, but there are two empty fields and student ID numbers which could be used for codes.

Adding and deleting students, printing records, and changing or deleting records are simple, menu-driven processes. There is no record-keeping which is mandated by the system. The only manual entry is done when making student assignments.

Most student records can be accessed only from the teacher station, using a code which does not show on the screen. If the code is broken, it can be easily changed.

Support/Service
There is a 800# hotline to provide answers to user questions. Also, CNS technicians can take control of a system via modem to make many system corrections. Users have reported no problems with their systems other than a few minor "start-up" glitches. Staff development is included with the system purchase.

Staff Reactions
The staff person interviewed was enthusiastic about the use of computer-assisted instruction and felt that having a management system such as ClassWorks enhances her ability to monitor student progress. She likes the variety of software chosen by CNS, saying that it helps to hold student attention. Her population, juvenile offenders, is not a group which would be expected to be enthusiastic about school, but she finds that they are eager to work on the computers and that all of them have experienced at least some success.

PLATO SYSTEM

Brief Description of System
The PLATO system is a product of Control Data which has recently been acquired by The Roach Organization in Rolling Meadows, Illinois. It is an open architecture system, which means that any software from the PLATO library may be completely integrated into the management system and it is possible to add non-PLATO software to the management system, although the record keeping for this type of software is not as detailed. Individual lessons may be selected and grouped in the management system as a particular course. For example, appropriate lessons could be selected and listed as "Pre-GED Reading." PLATO is designed to provide only computer-assisted instruction, although notebooks of supplemental worksheets are provided for duplication if desired.

Program Where Observed
The PLATO System was observed at Maywood School in the Highline School District in South King County. This school primarily serves alternative high school students, about 150-175 each month. The PLATO system, which has been in place for approximately 1 1/2 years, can be either supplemental to or a substitute for a regular high school program. Students in the program may be in-school suspension students, GED students, students who are waiting for the beginning of a quarter to re-enter a standard high school, seniors who are deficient in credits for graduation, or students who are completing a SAT-Preparation course. The lab is also used with a word processing class and is projected to provide parent education at a remote site.

The lab consists of thirty student stations and a manager station with a file server. The manager is a technician rather than an instructor. In the same building are alternative classrooms, staffed by certified teachers, and there is a building administrator. The lab manager does most of the interaction with both the system and students working in the lab, although the teachers often come into the lab to supervise their students who are using the lab. Students not in a structured alternative program attend the lab on a drop-in basis.

Cost Factors
There are several purchase options for PLATO. The least expensive option at the time of this report was an eight-station lab using already-owned computers for student workstations. The cost for this type of lab, with ABE, GED, and Coping Skills software, five days of staff training, and a 386 Control Center and printer would be about $42,000 the first year and an additional $4800 licensing fee to be paid in each of the next four years. The same system, with a paid-up licensing fee, would be about $56,000. Having The Roach Organization provide student workstations would increase the cost to $53,000 ($67,000 with paid-up licensing.)

A larger system, with 20 new student workstations and the same 386 Control Center, dot matrix printer, and

ABE, GED, and Coping Skills Software, costs $89,600 the first year with a $12,000 licensing fee for each of the subsequent four years or $125,600 with paid-up licensing.

Hardware
The system has a 386-based "control center" which, according to the publisher, can handle up to 100 workstations, but is much more efficient when handling no more than 50. A second hard disk with 1000 megabytes may be added for increased capacity. It also has available an administrator workstation, a 286-based dedicated processor.

Student stations can be Control Data workstations or other PC-compatibles, including IBM PS/2's. Either monochrome or color monitors are available. There is the capacity for connecting remote workstations over communication lines.

The operating system is MS-DOS, so that the system can run any DOS software in addition to PLATO courseware. The system does not use a mouse or pull-down menus or icons.

Quality of System
Many of the materials seem somewhat dated, but some lessons have been recently updated and are definitely better than those which have not. Updates at additional cost are available approximately twice a year. Basic skills math, reading, language arts, social studies, and writing have been updated in the last two years. Some courses are more extensive than others, and expanding those courses which need it is an ongoing effort.

Both monochrome and color monitors were examined. The color monitors are definitely worth the extra investment, making the graphics more interesting and some of the instruction easier to understand. The graphics are clear, but are less sophisticated than those of some other systems. At the beginning of each lesson, the same time-consuming graphic appears. The system does not take advantage of the high level which is possible with VGA graphics. There is no audio other than an occasional "beep," but it can be turned off if desired.

The system is generally bug-free, but as with any large system, there are isolated problems. In one unit, for example, the system won't record mastery and the lab manager must enter it; in another, it says "Here is the correct answer" but then doesn't give an answer. These small problems will undoubtedly be addressed in future updates.

The documentation which comes with the system is well done and fairly easy for the user to understand. Of course, the documentation cannot stand entirely alone; some training on the system is needed.

Instructional and management systems are reasonably crash-proof. The Highline District experienced only one software problem in a year and a half, and that problem was intentionally caused by a student with a high level of computer knowledge. The corporation assisted the district to increase the level of security within the system so that the problem has not recurred. Random system failures have been non-existent.

Assumptions about Learning
PLATO is a computer-based system, rather than multi-resource. Students who cannot or will not use a computer would not be able to use the system. It is a competency-based system, in which learners progress by mastering competencies rather than achieving a norm-referenced performance level. The competencies are taught discretely, rather than in an integrated fashion. A student selects a unit, such as "Using Evidence to Support Main Ideas," and completes a tutorial lesson followed by a drill and then by a test. If the student performs poorly on the test, he is cycled back into the tutorial and a different version of the drill. Review lessons for each unit and applications lessons are an attempt to increase integration and transfer of learning. The student menu lists the skills in the preferred order, but a student may choose to complete them in any order, so that s/he could choose to complete paragraph writing before basic sentence structure. This can be circumvented by programming a particular sequence or by setting prerequisite skills.

Instructional Design
The PLATO system uses a sequential approach to learning. Students see a menu of assigned lessons and may be able to select any one or may be programmed to complete the lessons in the order listed. In some lessons, objectives are stated clearly, but in others, only the lesson title gives an indication of the content and expectations. Students are in all cases given clear messages about the number of correct answers needed for mastery. There are several teacher options for directing a learner's movement through the curriculum. Learners can be programmed to complete all assigned objectives, regardless of performance or pretest results, or can be programmed to pre-test out of lessons they have already mastered and to review lessons when performance is low.

Many of the units are multiple choice, drill and practice. Some of the newer parts of the curriculum, however, introduce more variety in tutoring approach and question type, asking the student to estimate an answer or fill in a blank. A few of the questions do require higher-order thinking skills and several units have "application" lessons which use a life-skills approach.

The Roach Organization indicates that the instructional scope of the system is extensive, intended for a wide range of students (from elementary through college, including life coping skills and parent education). In some areas, such as job search and life coping, the curriculum lacked breadth, with only a few lessons and little significant content.

Curriculum materials for ESL are being released this spring but were unavailable for preview. According to The Roach Organization, this portion of the curriculum has digitized sound, begins at a very low level, is life-skill based, and was developed with the concurrence of a national advisory board.

Assessment/Placement
On-line placement instruments are available for ABE, GED, and CASAS, although they are not used by the Highline School District and were not available for viewing.

When new students begin at Maywood, they are shown a few basic keyboard strokes (such as Enter and Back), shown how to enter their names and passwords, and are then free to begin working on their assignments. According to the lab manager, the process takes under ten minutes and none of the students in that particular lab ever has any difficulty. [It's probably worth noting that their students are almost entirely adolescents, who in general have more exposure to computer use than older adults.] The PLATO System does not have an introductory lesson.

Each PLATO unit has a pretest, and it is possible to allow students to exit from a lesson when they pass the pretest. Progress is determined by the student's ability to complete a post-test with the required percentage correct. Results are immediate; once a student misses more than the allowed number of questions, the test terminates and the student is cycled back into the lesson. These tests follow the same format as the lesson questions, so can be said to measure the skills which have been taught. According to the publisher, students advance one grade level in reading for every 30 hours of instruction and one grade level in math for every nine hours of instruction. The Highline School District has not studied student results in this way. A California study with GAIN (welfare reform) clients showed 3-month increases of Reading, +2.89; Math, +3.00; Language, +2.01. Students in that study were 84% male; 52% Hispanic, and 15% African American; and generally above a 4th grade reading level.

Instructional Delivery
The PLATO system has 1500 hours of instructional materials, including basic skills beginning at a 3rd grade reading level, high school courses, instruction for CASAS competencies, job search skills, life coping skills, parenting skills, and GED materials which match the 1988 GED (matched in content, but not in question format). Higher order thinking skills are taught in a few lessons, but are not really emphasized. An ESL component has recently been added. Because of this breadth of curriculum and the ability to create customized courses, the competencies could be arranged to match the Washington State Core Competencies Curriculum Project.

Instruction is provided on the computer only, although there are also notebooks of optional worksheets which could be duplicated. The system does not generate and print additional exercises or refer students to other media for homework. Units of instruction are approximately 15-20 minutes, so that even students with a short attention span should be able to complete at least one lesson at each session. When a student exits, a "bookmark" will return that student to the start of the next lesson at the beginning of the next session.

The instructional materials were developed exclusively for PLATO. Other software can be inserted into the system and will be listed on the student menu. The level of the lesson instructions and text seems to be compatible so that a student who needs to study the content probably will be capable of understanding the introduction and instructions. However, the content of the lessons in some cases is only marginally appropriate for adults.

At the beginning of each session, the student sees a menu listing all of his/her assignments, with an indication of those assignments which have already been mastered. The student can select any of the lessons from that menu to complete, unless the instructor has "locked" the student into a sequential approach.

Questions are primarily multiple choice, with a few fill-in. Students in some cases must type in the correct answer before they can progress. As an example, when given choice A or B, if the wrong answer B is selected, the computer will respond "No," and will flip back to the choice. This will continue indefinitely until the student finally selects "A." In other cases, the computer will provide the correct answer after two or three wrong guesses. There is no provision for preventing guessing or random answers. However, the student report does show the number of guesses so that an instructor has access to that information. Also, on a test a student who misses more than the allowable number of answers is immediately cycled from the test back to the beginning of the lesson.

After initial instruction, there is ample opportunity to practice a skill. Even though exercises have a limited number of problems, it is possible to repeat the exercise and see new problems. The practice is very repetitive, however, with little or no variation in question or answer type.

Some of the courses take better advantage of a computer's capabilities for branching than do others. Overall, the system does not do a good job of this. There is no adjustment of difficulty levels or sequence according to student performance, and in most cases there is no provision for incorporating review questions or repeating questions which were missed earlier in the lesson. However, the "Problem Solving" lesson at the end of some units does provide a cumulative review of that unit.

A student can see that he is making progress because those skills which have been mastered are starred on the menu at the beginning of each session.

There are no estimates given for the time to complete portions of this curriculum. The Highline School District times typical students whenever adding a new component to the curriculum in order to have an estimate of the number of hours needed to complete that component.

Feedback

Feedback is generally positive and timely, and feedback neither threatens learners nor rewards incorrect answers. However, the feedback is generally not informative. An incorrect answer in a reading lesson brought the admonition "Be careful with those details!" A correct answer usually generates a positive comment such as "Yes," "Super," "Right," etc. and then the system moves to the next question. An incorrect answer generates a "No" with a general type comment and then the student either recycles indefinitely through the questions and answer or is given 2 tries, then the correct answer. Some of the newer parts of the curriculum, however, give the student a "hint" before asking him/her to try again. In a few of the math sections, there are "graphic" hints which give the student an illustration to help in visualizing the problem. There is no automatic provision for extra practice in areas of difficulty, but the student can choose to repeat a lesson even if mastery is achieved, and the student will automatically be recycled if mastery is not achieved.

Usability

The system could be implemented and used by staff with very little computer knowledge and expertise. The system is usable with a variety of printers. Both instructional and management systems begin with a menu, and on-screen directions are easy to follow. Responses to questions in most cases require one keystroke, or typing one word at the most. Returning to the menu or reviewing previous screens is possible at any time with a standard key stroke. Because most of the tasks are very simple, few on-screen directions are present or needed.

There is a "bookmark" feature so that if a student exits a lesson before completing it, he or she will return to that same place at the next session. There is a help key which is available in most lessons, but pressing it typically returns the student to the tutorial, repeating a general explanation of the content, rather than giving specific assistance. In a few cases, the student has the choice of type of help and can select either assistance with the content or with keyboard strokes or other types of program directions.

The management system runs with minimal delays, but the instructional system sometimes asks the student to wait for periods which seem excessive.

Major updates to the system make it necessary to clear the system of all student records; in the case of the Highline School District, this made it necessary to wait for summer to update the system in order not to lose records for the students who were currently active. However, the publisher made some suggestions about alternative ways to maintain records while updating the system.

Modifiability

New software from the extensive PLATO library is easy to integrate into the system. However, the PLATO courseware itself cannot be modified other than to set mastery levels or sequencing. It is possible to add other software to the management system, but it is outside a PLATO lesson. If this were done, a student menu would have a list of assignments that could include PLATO lessons as well as other pieces of software, but they would be listed separately and the only record-keeping for non-PLATO lessons would be lengths and dates of sessions and an indication of completion.

The lab manager or instructor may determine the mastery level for a particular PLATO course when it is added to the system. It is also possible, though slightly more complicated, to set mastery levels for individual students. There are default mastery settings if no modification is made. It is possible to limit the amount of time which a student has to answer a question and to specify whether a student must complete all of the assigned material or can skip portions of it by passing a pretest.

The lab manager has essentially three choices for moving students through the system: they can be "locked in" to completing all assigned objectives in the order assigned, students can be given complete control over order of completion, or pre-requisites can be assigned, so that a student must either pass a pre-test or master a previous objective before moving on.

Management of Student Performance

Relevant courses from the PLATO library are put into the system and new courses may be purchased from PLATO at any time. The "pre-packaged" courses appropriate for ABE include Reading (139 hours, grades 3-8), Math (95 hours), and Language (112 hours). Individual elements, or lessons, from those PLATO courses, could also be re-combined to provide customized courses. For example, certain math, reading, and language objectives could be selected and "packaged" as ABE Level 2.

When a student enters the system, he is assigned relevant areas of the curriculum, depending upon a placement test, upon the need to complete a particular course, or upon a student interview. The student will then move through the assigned material in any order (unless a sequence is "locked in"), seeing tutorials, completing practice exercises, and taking tests. Once a test is completed satisfactorily, that particular lesson or subskill is marked as Mastered.

Mastery is determined by percentage correct and is usually set for the course or objective rather than the individual student (it is possible, with some manipulation, to set mastery levels for individual students). If a student does not pass a test, s/he is cycled back through the same tutorial and/or drill and is then given another version of the test. There is no "branching" which would take a student to an expanded explanation of an area of weakness.

Because each skill is discrete, there is no provision within a lesson for review and reinforcement. A student continues to work on a particular objective until it has been mastered. Each unit does include a "review" lesson for all the skills taught in that unit. Once unit mastery has been certified, those skills are not taught or tested again, other than being used as a step to the completion of more advanced tasks.

Records Management

The PLATO system can generate either individual progress reports or class profiles. It is possible to obtain a class roster by calling up a list of student at the control center and then printing the screen. The system will print demographic and statistical information if it is entered, although there is no report format for this.

The system tracks student time at the computer (although not time on task) as well as student progress. It is very simple to add or delete students, to change records, and to print records as often as wished. Most of those functions are menu-driven. The Roach Corporation and PLATO require no record-keeping by hand, though programs will probably find it necessary to keep additional records, such as attendance, in some fashion.

Each user — students, instructors, and manager — has a password which keeps that file secure from others. It is also possible to increase the level of security within the system, but that makes some of the records management slightly more difficult. The Highline District did have one instance of a student breaking a code and altering some files, so they requested and received assistance in preventing other occurrences.

Support/Service

There has been little service needed on the Highline system in the year and a half it has been in place, but when service was needed, it was provided in a timely fashion. The Service Center, located in San Jose, California, has been extremely responsive to the Highline Center, usually arriving the same day or next day at the latest when on-site service is required. There is also a hotline for help, and the system itself identifies problems by number so that when the technician calls for assistance, the problem has already been diagnosed and the service center can usually provide assistance over the telephone.

There is no formal user support group; the Highline District feels that the hotline provides all the support necessary. The PLATO organization does not require any type of reporting or paperwork.

After the initial three days training on a new system, two more follow-up days of staff training are available and it is suggested that they be scheduled after the system has been in place at least a month.

Student reactions

The students who were interviewed had not used computers before, so had no basis for comparison. Generally they like using the computers because it's possible to work individually, because the system is easy to use, and because feedback is immediate. They feel frustrated only very occasionally, although the students who had been "locked in" to a sequence because of Highline's program design expressed frustration that they were forced to complete all portions of the lesson even when they got a perfect score on the pretest. Students feel that this introduction to computer use will be beneficial in future activities, but think that the graphics are rather childish and time consuming (they were working with an older, monochrome system) and would like to be able to take work home.

Staff Reactions

The lab manager would like to be able to view student screens from the control center and would like the system to "log off" after a period of inactivity in order to prevent students' sitting and staring.

The building administrator, who was instrumental in selecting the system, chose it because of its flexibility, the scope of the curriculum, and the open architecture which makes it possible to add curriculum and hardware components, such as audio or color monitors. He would like to see even more added to the curriculum, especially Social Studies and Science, where enhanced graphics could substitute for experimental laboratory courses. He is looking forward to increased remote capabilities, which are in the process of development.

WICAT SYSTEM

Brief Description of System
WICAT is published by WICAT Systems of Orem, Utah. It might be considered a "semi-open" system, since any WICAT software can be completely integrated into the management system but non-WICAT software can only be listed on the menu. The latest version, which runs on an IBM system, can use any IBM software, and non-system software can be listed on the menu, although student performance will not be monitored or recorded. WICAT has assessment instruments which are taken on the computer, including a basic skills test, official GED Practice tests, and a learning styles inventory. These assessments are used in making learning prescriptions for individual students.

Program Where Observed
The system was observed at Clover Park VTI, in Tacoma , where it has been in place nearly one year. Sixteen student work stations provide the bulk of ABE/GED instruction and are available for supplemental work by vocational or pre-vocational students. The lab serves about 700 students per year. Staffing was in a transitional phase at the time of our visit, but generally the lab is staffed with one instructor. Most students seem to spend 1-2 hours daily using the system.

Cost Factors
The cost for an eight-station lab, including all needed hardware, software, 1 year warranty, 10 days of training (five days initially, then five more days as follow-up during the year), and support and service is $60-65,000, depending upon the particular hardware and software selected. In subsequent years, the licensing fee is 10-13% of the purchase price. This licensing fee covers all needed service, an 800# "hotline," system updates, and up to five days of staff development. The per-station cost for a lab declines as the number of stations increases. For example, 16 stations would be $83-91,000; 24 stations would be $106-114,000; and 32 stations would be about $130,000. These numbers are just for comparison — it is not necessary to buy work stations in sets of eight.

Hardware
A program purchasing a WICAT system could choose to integrate hardware which is already owned in order to save a portion of the purchase price. It is also possible to choose either monochrome or color monitors, depending upon the available resources. Work stations may use IBM, Apple, or Tandy computers. The central file server can be expanded to manage up to 64 work stations. It is technically possible to serve remote sites with a modem, but WICAT does not recommend it. Their lessons are so complex that transporting them by modem would cause a significant delay, which violates their principle of having a maximum 2-second response time to every key stroke.

The base system varies with the hardware selected, but the newest and most popular configuration runs on an IBM I-class network (IBM model 60). Graphics are either MCGA or VGA, and the system uses digitized audio. It will support any of a wide variety of printers.

The system does not use a mouse for graphic interaction with icons and pull-down menus.

Quality of System
Some modules are more current than others, and these provide more sophisticated graphics, feedback, and

branching. Updated material is provided as it becomes available as a part of the annual licensing fee. Either monochrome or color monitors can be provided, and the color monitors are much superior for taking advantage of the graphics available. The publisher claims that the system has "exceptional animated graphics and the most sophisticated color in the industry." It's difficult to say whether that claim is justified, but the graphics are well done.

The audio can be turned on or off for individuals or for the entire class. Initially, it seemed acceptable, but in situations where slight distinctions were important, it was not clear enough. For example, in Reading I, it was impossible to distinguish between "back" and "bat," and "fat" sounded like "sat" (which led to selection of an incorrect answer and could create student frustration). In Spelling, students are asked to listen to a word and then spell it, but it's necessary to rely heavily on the sentence content to discern what the actual word to be spelled is.

The size of print and screen clarity seems fine, with small exceptions. In the Algebra program, it was very difficult to see which operational sign (+ - x ÷) was intended.

System documentation is extensive and easy to use for someone who has completed training; it could be rather complex for someone without that background. Clover Park has had no difficulty with system "crashes," but as a matter of routine the system is backed-up on tape on a daily, weekly, and monthly basis.

Assumptions about Learning

WICAT is a computer-based system, rather than multi-resource. Students who cannot or will not use a computer would not be able to use the system. It is a competency-based system, in which learners progress by mastering competencies rather than achieving a norm-referenced performance level. These competencies are taught and tested discretely, but there are real-life applications and use of basic skills as tools of communication, which may encourage the transfer of learning.

Instructional Design

WICAT uses a sequential-type presentation, with students mastering one learning objective and then moving on to another. The system itself does not require students to complete lessons in a simple before complex order, but it's possible for an instructor to assign lessons in a particular sequence, so that a student must complete the beginning lessons before attempting the more advanced ones. There is also extensive branching within an objective, providing extra instruction or practice for students who need it.

Areas of instruction include basic skills at levels K-12 and adult, and a typing module which serves to introduce students to the keyboard. Presentation of instruction is generally appropriate for adults. The lab manager at Clover Park VTI feels that materials seem to be higher than stated levels, about +1 grade level. The statement of learner objectives is done through lesson titles rather than being explicitly expressed in the lesson. The spelling module is sight-based, and the basic reading curriculum is a combination of some phonics and some memorization. Problem solving is emphasized, especially in the modules which have been recently updated.

Assessment/Placement

WICAT has the WICAT Test of Basic Skills, WICAT Skills Assessment Tests, and WICAT GED tests available on-line. A customized test creation option makes it possible for a teacher to make, store, administer, and score tests on-line, selecting items from an item bank. The GED tests are short and long forms of the official GED practice test. Both the test and diagnosis are on-line, and the system will prescribe lessons for each missed objective. Also available are Ability Profile Tests which can be used to determine learning styles and a "dynamic placement" option which allows a student to omit an objective or move ahead or back, based on performance. These tests are not required for placement into the system; in fact, Clover Park VTI uses the TABE. If an on-line test is used, the system will suggest lessons, but the teacher must enter those which s/he wishes to assign. None of the tests gives information about the time and effort necessary to reach a goal based on assessment.

Placing a student into the system can be done fairly quickly once decisions have been made about what the assigned lessons will be. There is no orientation lesson for the student other than a ten minute keyboarding lesson which does a good job of introducing the important keys. The assessments within lessons as well as the unit tests seem to do a good job of measuring the skills which have been taught. According to the publisher, programs have experienced significant gains in performance levels and decreases in dropout rates. In one study, of students who spent at least 60 hours in reading and math remediation, 100% passed the corresponding portions of the GED on the first try. Clover Park has not done a formal assessment of student performance gains.

Instructional Delivery

The system can provide 2,500 hours of instruction at levels K-12. Many of the WICAT competencies are similar or identical to those of the Washington State Core Competencies ABE and GED curricula, but not the ESL curriculum. It seems particularly well-thought-out in the GED area, which is based on the 1988 GED. Although it is used with some ESL students, they must be somewhat literate and able to understand spoken English. The Clover Park VTI Lab Manager agrees that the ESL curriculum is not as well developed as it might be.

Instruction is provided exclusively on the computer. The system does not generate additional printed exercises for homework or refer the student to other media such as workbooks or videotapes. The instructional modules make excellent use of the computer's branching and graphics capabilities and of its function keys. Generally lessons seem to be a reasonable length, although the length depends upon student performance. Many wrong answers and requests for help could lengthen the lesson. Eventually, if performance is poor enough, the screen says "Stop — see your teacher" and the student cannot proceed any farther.

The instructor can determine the amount of student control. Lessons may be presented in a pre-assigned order, or the student may have complete control from a menu.

Generally, program directions and instruction seem to be at approximately the same level of difficulty and are appropriate to the age and learning style of ABE and GED students. The Reading I curriculum has an audio component, which allows a student to hear as well as see directions and instructional material. (There are some concerns with the quality of the audio — see "Quality of System").

There is a variety of question and response types, sometimes choosing a multiple choice answer, sometimes underlining a word, sometimes typing in a response. In most cases, a student must respond and cannot advance simply by hitting the return key. The amount of practice seems sufficient. Most lessons allow a student 2 trials, then the answer is supplied. Hints are often given after an incorrect answer. Branching provides additional practice and review, but the system does not adjust the level or sequence of presentation based on student performance. The number of problems is limited if a student achieves mastery quickly or misses too many, but otherwise students can continue to request practice problems until they feel comfortable with a skill.

Guessing and random answers are discouraged, although not completely prevented. In some cases, after a student initially chooses a wrong answer, he is required to enter the correct answer from a model before being allowed to progress.

Review questions are included, especially if a student has had difficulty with a particular concept. Questions answered incorrectly are not repeated, but the concept is usually reviewed.

Progress is usually charted, sometimes within the lesson, so that a student is motivated to do well. There is often a graphic depiction of progress, such as checks after lessons mastered, the number correct shown on a bar graph, etc.

In the newer lessons, there is emphasis on the teaching of problem-solving and thinking skills, both in the type of problem presented and in the help given upon request or after an incorrect answer. The publisher

states that the system is "designed to provide students with the thinking skills they will find useful in the information age."

Feedback
After an answer, feedback is immediate and positive in tone. It neither threatens learners nor rewards incorrect responses. Some of the older modules, such as Spelling and Algebra, have feedback which is less varied and less helpful than the updated modules such as Reading. The older modules typically have a "No," or a "That's right!" type of response. In the newer modules, the system will either explain why the choice was correct, or explain why it was wrong, give additional information, and encourage the student to try again. Feedback is content specific and related to a logical process of answer seeking. For example, when a 7 was entered instead of a 9, the computer responded "the 7 is not correct."

Usability
In order to implement the system, instructors need no computer knowledge; however, the system is complex enough that training would be imperative. Students also have no need of computer knowledge. A keyboarding lesson teaches function keys, then on-screen commands and directions are user-friendly, making continued use of the system quite simple. Most student responses require one keystroke or one word. Both instructional and management systems are menu-driven.

An on-line calculator is available in appropriate activities. There are "repeat" and "back" keys which allow a student to repeat a frame or to back up several frames, or it is possible to press the Escape key to leave the lesson. Generally, a student can either repeat or skip forward, but it depends upon what part of the lesson he's in. The "back" key is not always available, so in some cases, it would be necessary to escape the lesson and start again. A bookmark feature returns the student to the screen which was most recently completed during the previous lesson.

Hints and on-line help are available with function keys; prompts at the bottom of each screen indicate what special keys are and when they're active. However pressing the "information" key at some points moves student into what seems to be a totally unrelated help screen. At that point, the student can return to the lesson by pressing the Escape key.
The instructor can follow a menu to generate reports. The process is multi-step and somewhat complex, but it's possible to "save" a report format so that generating the same report a second time is much simpler. Reports are not available on-screen; they must be printed out. Additionally, the management system may experience minor delays when many student stations are active. Updates to the system should not disturb student records, although the lab at Clover Park did experience a minor problem during a recent update. The lab manager feels that it was unusual and should not recur.

Modifiability
It is simple to add WICAT modules or lessons to the management system, but it is not possible to add to or modify the content of a WICAT lesson. Using the student option menu, an instructor can easily change such parameters as rate and mastery level and can add a timer if it seems desirable to have a student complete a task within a preset time. Default settings are available also if the instructor does not wish to customize an assignment.

WICAT now runs on an IBM I-class platform, so that the hardware can be used to run any IBM software. Although such software cannot be added into the WICAT system, it could be listed on the I-class menu.

Management of Student Performance
It is possible to assign objectives selectively for either a class or an individual student and is also possible to change the types of activities, the starting point in a sequence, and the amount of control over that sequence which the student will have.

Within the context of WICAT curriculum materials, unneeded areas of the curriculum can be eliminated and other areas can be substituted. It is also reasonably simple to select certain objectives and "repackage" them

as a separate course. Assessment within a lesson generally means drill until the skill is mastered or the student cannot get any correct. If a student does not pass a test, he is given the option of repeating the lesson, but the system does not shift a student into a simpler area of the curriculum or an alternative presentation of the material.

The instructor can change the scoring criteria for an objective or for a single student, altering the number of questions presented and the % correct for mastery. Student progress reports do include time on task, but mastery is equated only with % correct.

Records Management

The system will provide class rosters, individual progress reports, and class profiles. Since it's possible to enter as many student "fields" as desired, it would be possible to collect demographic data as well, but the system does not have a report format which would utilize it. This would make it difficult to use the system to generate program statistics (such as number of students receiving public assistance, etc.) for proposals and reports.

The system tracks and reports student time on each lesson as well as progress. It is very easy to add or delete students, to change or delete records, and to print records, since all of these are menu choices. There is no record keeping which would need to be done manually.

The system does not have a high degree of security. In order to access the management system, it is necessary only to know the code and to have access either to the management station or to an enhanced student station. Codes can easily be changed if necessary. It isn't likely that any software could be inadvertently erased or edited, since the "default" in every case is the option which is most protective of the system.

Support/Service

The publisher does not impose any reporting requirements on the purchaser. There is technical support and service available locally and response to problems is immediate, dependent upon immediacy of need. A hotline is available, which is adequate for solving most problems. In a year of usage, Clover Park VTI has experienced one hardware problem.

Staff training is provided with the initial purchase and ongoing staff development is provided as a part of the annual licensing fee. Clover Park has received only limited follow-up staff development and feels that may be because WICAT has only one trainer available for the entire western region.

WICAT has recently begun to hold occasional user's conferences.

Student Response

The five students who were interviewed had never before participated in an individualized educational program and except for one had never used a computer in an educational program before. Three of the five felt that the computer instruction was preferable to more traditional methods of instruction, but one felt he would prefer to have more teacher involvement, and another felt that the computer gives so much help that she couldn't be sure she was actually learning material and would be able to apply it in other situations.

All found the on-screen instruction easy to understand, but one mentioned that the instructions prior to each lesson are so long and detailed that they are confusing. The instructor confirmed that she frequently tells students to skip through the instructions.

Students would like to be able to have worksheets to take home to reinforce what they are learning. One student takes copious notes from the screen and then studies them at home.

Features especially appreciated by the students include the bookmark feature which allows a student to begin where he last stopped, the immediate feedback, and the fun of using a computer. Problems mentioned included the barrier of keyboarding for someone who has never typed before, and a general feeling that in

order to benefit from the system it's necessary to be highly motivated — that otherwise it would be possible to "slide through" exerting little effort. They all felt that this introduction to computer use would be of some value in later educational or occupational experiences.

Section 5: SUMMARY MATRIX

System	CCC	CCP	ClassWorks	PLATO	WICAT
Manager Station/ Operating System	Microhost/ UNIX	Apple with 3 drives(old) or IBM/DOS 3.3	Apple IIe or IIGS with LAN/ DOS 3.3	Control Data 386/ MS-DOS	IBM Model 60/ I-Class (newest)
Workstation Options	IBM, Atari, Tandy, Apple IIe/IIGS	varies with software, stand-alone	Apple II, IBM, or MS-DOS	Control Data or other PC (incl. PS/2)	IBM, Apple, Tandy
Maximum No. of Stations	128	no limit, non-integrated	40	50 (100 w/less efficiency)	64
Remote Capability	yes	no	no	yes	yes; not recommended
Available Curriculum Materials for ESL	Listening, Reading, ESL-specific instructions in six languages	Listening/ Speaking, Reading/ Writing ESL-specific	some of software packages may be useful with ESL; no ESL-specific	Listening/ Speaking, ESL-specific; new release	ESL specific at very low level, Listening only
Available Curriculum Materials for ABE/GED	1700+ hours of CAI written for CCC	print, AV, and CAI from various publishers and (new version) written for CCP	1500 software programs from various publishers	1500+ hours of CAI written for PLATO	2500+ hours of CAI written for WICAT
Authoring System?	no	on new system, tests, test key, lessons, graphics	no	no	tests
Peripherals	mouse, sound	not with computers; system has other AV components	sound	sound with ESL coming soon	sound
Reports available	assignment results incl. time spent, grouping, gains report, time needed to reach goal (optional, extra $$)	test performance, student hours, mastered objectives, program data, student demographics	assignment results, class roster, class status, class summary, mastered objectives	progress reports incl. time spent, class profiles	individual and class progress, incl. time spent
Student Records Capacity	5000 student records	Apple w/floppy limited only by number of disks; new IBM limited only by storage capacity of hard drive	2000 students with up to 9 classes each	limited only by disk storage capacity (which can be increased) Standard system is at least 2000	limited only by disk storage capacity. Standard system is 35,000

System	CCC	CCP	ClassWorks	PLATO	WICAT
Hardware usable with non-system software?	yes	yes	yes	yes	yes
Staff Training	3-4 days initial, follow-up as needed, regular site visits	6 days initial installation and training required, 2 days follow-up recommended, regular re-gional/national conferences and user support group	2 days training and installation; more may be arranged as required	3 days initial, 2 days follow-up	5 days initial, 5 days follow-up if trainer is available
Support/ Service	800# hotline, local technicians, with IPS module, technicians can work on system via modem	800# hotline for systems operation, assistance also available via modem	800# hotline, technicians can work on system via modem	800# hotline, systems identifies problem by number, technicians in San Jose	800# hotline, local technicians
Approximate Cost [Note: This information is only included for general estimation purposes. Systems vary widely and cost is often highly negotiable, so none of these figures should be considered absolute.]	$53,000 for mgmnt station, 8 work stations, least expensive software, training, set-up, 1st yr. license. ESL component and IPS software are extra cost.	$49,000 for mgmnt station, 8 work stations, 3 video recorders,5 audiocassettes all needed print, AV, and soft-ware materials, implementa-tion and training	$37,000 for mgmnt software, hard drive and connectors, installation, and least expensive ABE & GED instructional software. Computers must be already owned or purchased separately.	$53,000 for mgmnt station, 8 work stations, software, training, set-up, 1st yr. license	$60-65,000 for mgmnt station, 8 work stations, software, training, set-up, 1st yr. license
Upgrades	annually, included in maintenance	new modules available for purchase	management upgraded periodically	upgrades available	annual upgrade included (can trade software as desired)
Annual Licensing/ User Fee	$200 per terminal for updated software, ongoing	$1000 ongoing for members of collaboration	$1000 optional for service/upgrade, ongoing	$4800 for 4 yrs. (then paid-up)	10-13% of purchase price, ongoing

APPENDIX 1
Preliminary Survey Results
Computer Use in Northwest Adult Basic Skills Programs

Program Name	System	Contact Person
WASHINGTON		
Big Bend C.C. (PIC-sponsored JTPA program)	CCP, looking at Pathfinders	Susan Fish
Clallam Bay Correctional Center ABE Program	stand-alone Apple, Mac, IBM, instruction and record-keeping	Daren vom Steeg
Clover Park VTI	WICAT	Kathy Kieffer
Columbia Basin College	CCP	Russ Schmeeckle
Community Colleges of Spokane	stand-alone Apple and IBM	Dennis P. Glass
Seattle University, ELS	stand-alone Apple	Donn Calloway
Garrett Heyns Education Ctr.	stand-alone Apple and IBM	Fred Mueller
Highline School District	PLATO	Bill Guise
Renton VTI	stand-alone Apple and IBM	Joy Barker
Seattle Central C.C.	stand-alone Apple	Sarah Hogan
Seattle Urban League	CCP	Gary Johnson
Skagit Valley College	CCP	May Haley
Tacoma Community College	WICAT	Stephanie Allen
Walla Walla Comm. College	stand-alone Commodore 64	Dennis Moore
Washington Institute of Technology	CCC	Richard Johnson
OREGON		
Blue Mountain Comm. College	stand-alone Apple	Patricia Amsberry
Career Enhancement Center, LaGrande	CCP	Mary Ann Miesner
Central Oregon Comm. Coll.	stand-alone Apple/Mac	Dianne Dean
Central Oregon Intergovernmental Council, Redmond	CCP	Meredith Junge
Chemeketa Comm. College	ESC/Jostens, ClassWorks, networked Apples	Lucy MacDonald
Clackamas Comm. College	Pathfinder	Jim Messer
Clatsop Comm. College	stand-alone Apple, Mac, IBM	Debbie Kaspar
Community Services Consortium, Albany	CCP	Gregory Buell
Community Services Consortium Corvallis	CCP	Joann DeMott
Job Council, Medford	stand-alone Apple	Ken Frires
Klamath Adult Education Program	Education Technology	Claudia Rizzuto
Klamath Lake Employment Training Institute	CCP	Paula Pence
Lane Community College	stand-alone Apple, Mac, IBM	Leslie Rasor
Linn-Benton Community College	Apple instruction, IBM record-keeping	Candice Johnson
Mid-Willamette Jobs Council	stand-alone IBM, NCR	Dayna Bergeland
Mt Hood Community College	stand-alone Apple	Brenda Button
Oregon Coast Community College	stand-alone Apple, IBM for instruction and record-keeping	Dawn DeWolf V. Tardaewether
Socrates Alternative Education	stand-alone Apple and IBM	Rick Foertsch
SW Oregon Community College	stand-alone Apple, Mac, IBM	Keith Hulsey
Treasure Valley Community College	CCP	Art Clawson
Umpqua Community College	Education Technology	Doris Leonard
Career Enhancement Center, LaGrande	CCP	Mary Ann Miesner

Program Name	System	Contact Person
BRITISH COLUMBIA		
Camosum College, Victoria	Pathfinder	J. Hoston
Capitano College, North Vancouver	stand-alone Apple and IBM	Robert Irvine
Kwantlen College, Richmond	stand-alone Apple and IBM	M.E. Enns
Malaspina College, Nanaimo	stand-alone IBM	Paul Hurwitz
Malaspina College, Powell River	stand-alone Apple and IBM	Chris Tunstall
North Island College	stand-alone Aopple and IBM	A.C. Lindsay
Northern Lights College	record-keeping only	Patricia Walker
Northwest Community College, Prince Rupert	stand-alone Apple	Marie Grinstrand
Northwest Community Coll., Terrace	stand-alone Apple	Larry Bolingbroke
Okanagan College, Kelowna	stand-alone Mac	Terry Buker
Okanagan College, Salmon Arm	stand-alone Apple	Paul Grinder
Selkirk College, Castelgar	stand-alone Apple and IBM	Carlton K. Scott
Selkirk College, Nelson Campus	Libcat (Apple and IBM)	Marvin Work
Vancouver Community College	stand-alone IBM	Cindy Onstad

APPENDIX 2: EVALUATION INSTRUMENT

General Program Information

Name of System:
Publisher's Rep:

Publisher:

Brief Description:

Program Where Observed:
Contact Person:

Length of Time System has been in place: Number of Students Served Monthly:

Student user group(s): (ESL, DE, ABE, etc.)

Uses of system other than with basic skills students:

What is relationship of system to the overall instructional program?

Cost Factors

Estimated cost for ____ work stations, file server, necessary staff training, set-up costs, initial licensing:

Annual licensing fee:

Is maintenance contracted or provided for an hourly charge? What are the costs? What is included?

What flexibility is there in the system design? Is it possible to buy only some of the components?

Is it possible to customize the system by purchasing different modules? If so, what is the approximate cost per module?

Are upgrades to the system available? If so, at what cost? How often?

Is the system expandable? cost per terminal expansion?

Assumptions about Learning

Is there a model of learning (such as learner-directed, teacher-directed, etc.) behind the system? What is it?

What is the basis for the system? (phonics, memorization, problem solving, etc.)

Are learner objectives stated clearly? Is purpose well defined? Do students know what is expected of them?

What are the identified areas of instruction? What is the identified audience? (age, goal [such as high school credit, GED prep, employment/life skills]

Does the learning build on itself? (simple before complex, knowledge before synthesis)

Is the medium and delivery appropriate for identified audience and content? Does the choice of medium vary with the student and/or topic?

Would the system be usable with a student who dislikes computers?

Usability

How much computer knowledge is required of instructors to implement the system? of students?

Do both instructional and management systems begin with a menu?

Are directions and on-screen commands and responses user-friendly?

Is it easy (for the learner as well as the teacher) to return to the menu at any time?

Are there on-screen directions and are they easy to access?

Is it simple for a learner to review instructions and previous frames?

Is there a "bookmark" feature?

Is help available at likely points of need?

What level of typing skills is needed? (one stroke responses, single words, sentences and/or paragraphs)

How easily can reports be generated by students and teachers? (test results, attendance reports, progress reports, etc.)

Do the instructional and management systems run with minimal delays?

Can the system be used easily with a variety of printers?

Are student records affected (ex. deleted) when the system is updated?

Modifiability

Can new software be added to management and instructional systems? How easy is the process?

Can an instructor easily change or add content to computer lessons? to supplemental materials? (Are supplementary activities easily added/incorporated when students need more review or drill?)

Can an instructor easily change parameters such as rate or mastery level?

Are default settings for these parameters available?

Can the hardware be used for other purposes, i.e. word processing, programming, etc.? Are there modifications required?

Assessment/Placement

Is there a placement tool? If so, describe, including norming, quality, length, on-screen or paper/pencil, scannability. If not, describe the method for placing students in the system.

Is the placement tool usable with all students? (ex: not with beginning readers, ESL, etc.)

Is the student given information about time and effort needed to reach his/her goal (e.g., placement correlated to predicted GED scores.)

Does this placement tool automatically lead into instruction or is it necessary for the instructor to enter assignments?

How long (teacher and student time) does it take to start a new student? What type of orientation is available for a new student?

Describe the process of assessing progress, including cirteria to determine mastery. (How are tests administered/graded? How soon are results available?))

Do the assessments measure the skills which have been taught?

Are students learning? (Give data if available)

Records Management

What records management features are available? What reports are available? (attendance, class rosters, individual progress, class profiles, program statistics, student demographics, etc.)

Can statistics be generated easily for reporting and fund raising?

Who is responsible for tracking time and protress? (computer, instructor, student)

Is it necessary to do any record keeping by hand?

How difficult is it to add or delete students?

How difficult is it to print records as often as wished?

Can records be changed and/or deleted?

Describe security measures in the system. Do students have access to any part of system other than instructional?

How destructible are the hardware and software components of the management system?

Management of Student Performance

Is it possible to select only some of the objectives for a class or an individual student?

Can unneeded areas of the curriculum be eliminated? Can other areas be added?

Is it possible to select certain objectives and "repackage" them as a separate course?

Can the instructor select mastery levels? How difficult is the process?

Is movement through the curriculum based on assessment of mastery? Are tests based on level of student? level of material? How frequent are the assessments?

What happens when a student does not pass a test? Is there "branching" which moves a student up, down, and sideways in the curriculum?

Does "mastery" reflect anything other than % correct? (such as error pattern or time elapsed between question and response?)

Quality of System

How current is the material? (software as well as print and other media)

Are updates available? How often and at what costs?

Is the size of print and clarity of screen image acceptable for adults?

Is the content accurate and free of "bugs" as well as grammar, spelling, punctuation, and usage errors?

Are graphics clear, easily interpreted, and appropriate for adults?

Is the audio clear? Can it be adjusted or turned off?

Is the system documentation well done and easily used?

How "crash-proof" are the instructional and management systems?

Instructional Delivery

What is the breadth of the available curriculum? (What courses are available and how many hours of instruction? academic? life skills? high school? GED?)

Is the curriculum appropriate for the Washington Core Competencies Curriculum?

With what student levels would the system be useful? Does that match the published intended audience? Would it be useful with ESL students?

What instructional and testing materials are used? (computer? workbook? video cassette? tutoring? lecture? discussion?)

What is the ratio of time spent on CAI to time spent with other media?

Does the CAI portion of the curriculum take advantage of the computer's capabilities? (or is it simply drill and practice?)

Were the materials (software, video, print, etc.) developed for this system or are they a collection of programs from various publishers?

Will the system generate and print additional exercises for homework? Will it refer the student to other media for homework exercises?

Are the units of instruction an appropriate length for a student's attention span?

Does the system have a "bookmark" feature so that the student can return to the same place at the next session?

To what extent is a student involved in the decision about what to study and/or emphasize? Is a student given a menu of subject areas at each lesson? Can students alternate between math and reading, for example?

Are the program directionand the instructional material at approximately the same level of difficulty? Are they appropriate to the age and culture and learning style of the intended audience?

Are any estimates given about time for a student attending regularly to complete a unit of the curriculum? If so, what are they?

Can students truly work individually? Are "drop-in", infrequent attenders a problem?

Does the student have control over the program; can he move backwards as well as forward and repeat when desired?

Is there a variety of question types? What does the system do to "involve" the student in providing responses?

Is there sufficient exposure, opportunity for practice, and variety for a student to be able to master skills? Is there a limit to the number of problems a student can do in a section?

Is there any means for preventing guessing or random answers?

Is the number of trials allowed reasonable and appropriate?

Are hints given after incorrect responses?

Does the program use branching to automatically adjust difficulty levels or sequence ac cording to student performance?

What provision is there for review? Is there an automatic system for incorporating review questions?

Are questions which are answered incorrectly repeated later in the lesson or exercise?

Is there transfer of learning? Do CAI skills transfer to pencil and paper applications? Can the student apply learned skills to real-life situations?

Are higher-order thinking skills taught?

What means is there to assist the student to feel he is progressing?

Feedback

What type of feedback is given for a correct answer? For an incorrect answer?

Is the feedback positive and timely?

Does feedback threaten learners or reward incorrect responses?

Is feedback informative and corrective when appropriate?

Is feedback varied? Is it ever boring or unnecessarily detailed?

Support/Service

Does the vendor/publisher impose any requirements such as reports or volume of use?

Is there technical support and service available in this general area?

Is there a hotline?

How much technical service have you required on the materials, software, and hardware?

Is staff development included with system purchase? If not, is it available?

Is there a network of users which serve as a support group? Are conferences held for users?

Staffing

What level of staffing is necessary to operate the system?

Are certified teachers necessary or desired?

Describe teacher duties/responsibilities.

Describe aide duties/responsibilities.

Does the staff need a high level of expertise with computers? with the system?

How much staff training is required? Is it adequate?

Is follow-up training available? What is the cost?

How much paperwork/clerical time is needed? Is that time evenly distributed or concentrated in certain time periods?

Facilities Scheduling

What are the room/space requirements for the system?

Is there a required attendance pattern or schedule for students?

How many students can be served each day at one terminal?

How long would a student be at the computer station at one sitting?

Can the terminals be scheduled and used for other purposes such as programming or teaching word processing?

Hardware

What hardware is included in the basic system? color or monochrome monitors?

What is the base system storage capacity and operating system?

Is there expansion capability?

Are there peripherals which are necessary/included?

What type graphics and audio?

Can students interact graphically? (pull-down menus, icons)

Student Questions

Have you been in an individualized educational program before?

Have you used a computer in an educational program before?

Do you think the computer instruction is better or worse than books and workbooks?

Is it easy to understand the computer lessons?

Can you do the lessons on paper after doing computer lessons? Which do you prefer?

Do you ever feel frustrated?

Do you enjoy using the program? What things do you like and dislike about it?

Do you think this use of a computer will be useful in any other part of your life?

General Observations

Strengths/Weaknesses

Comment:

Souce:

Appendix 3

Integrated Learning Systems
Checklist for Evaluation

Program Design Factors:

1. Staffing needs: Clerical, Technical , Instructional
2. Facilities
3. Scheduling

Cost Factors:

1. Cost of system, including needed hardware and software and ongoing licensing or user fees.
2. Possibility of leasing system rather than outright purchase.
3. Possibiity of using already-owned hardware.
4. Possibility of using hardware for otheer purposes, such as word processing or computerprogramming classes.
5. Type of computers for management and student stations.
6. Other hardware requirements (printer, modem, speech synthesizer, etc.)

Usability Factors:

1. Control over program: on-screen menus, ability to "back up."
2. Default settings for speed, mastery, etc:, which can be either accepted or modified.
3. Level of computer expertise and typing skill needed for students and staff.
4. Speed of response time in management and instructional software.
5. General ease of use in generating reports, making assignments, modifying settings.
6. Openness of system: ability to add or rearrange curriculum.
7. Support and Service provided

Curriculum Factors

1. Method of assessment and placement into system.
2. Movement through curriculum (sequential, branched, and/or spiraled)
3. Clarity and relevance of learning objectives.
4. Quality of curriculum materials, including instructional software.
5. Currency of curriculum materials, including software.
6. Variety of question and response types.
7. Prevention of guessing or random answers
8. Application of curriculum materials to life situations.
9. Teaching as well as testing of higher order thinking skills.
10. Feedback that reinforces after correct responses and assists after incorrect responses.
11. Criteria for mastery
12. Ability of student to see progress.

Recordkeeping Factors

1. Amount of recordkeeping done manually vs. automatically.
2. Amount of required recordkeeping
3. Reports generated by system.
4. Number of records which the system can store.
5. Demographic and programm data which can be collected and reported.